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Back cover: *Water buffaloes (Photo by R. Waller, issued by FAO)*

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EDITORIAL

One year. Nearly one year that I have been with you. One year, and what have I done, what have we done? Time is flying, and time is our enemy.

We all know – as Karen Blixen wrote "the Wilderness of only half a century ago, then so completely itself, has been reduced tree by tree, animal by animal, rock by rock to its last rutted corners. The few remaining spaces have been infiltrated, divided up, domesticated, deprived of natural processes, systemised, similarised, artificialised, sterilised, commercialised, . . ."

We all know. And the whales, the forests, the elephants, the rhinos, they are all abandoning us one, by one, leaving us so desperately lonely on a claustrophobic – planet overpopulated by only our greedy and short – sighted species. We know.

If there is one hope left, it doesn't lay in a sentimentalism of any kind. If there is one hope, it crys for action. For action and for a complete and international revolution in mankind's spirit. Otherwise, it won't be long before this can be said of our species: "they were deprived of the habitat they required. Require means, *depends on*, and we will soon find out the degree of our dependence on all the things, the irreplaceable things we're losing." (P. Beard)

I will soon be leaving the TIGERPAPER office, to join the FAO National Parks Development Project in Indonesia. I will certainly keep in touch, from the field, and I will be very happy to hear from the many people with whom I have had the pleasure of corresponding, and all those I have met during the last year. I thank you all, and wish you the best of luck in achieving our common objective!

Roseline Beudels

CONSERVATION OF WILDLIFE AND FORESTS IN SOUTHEAST ASIA

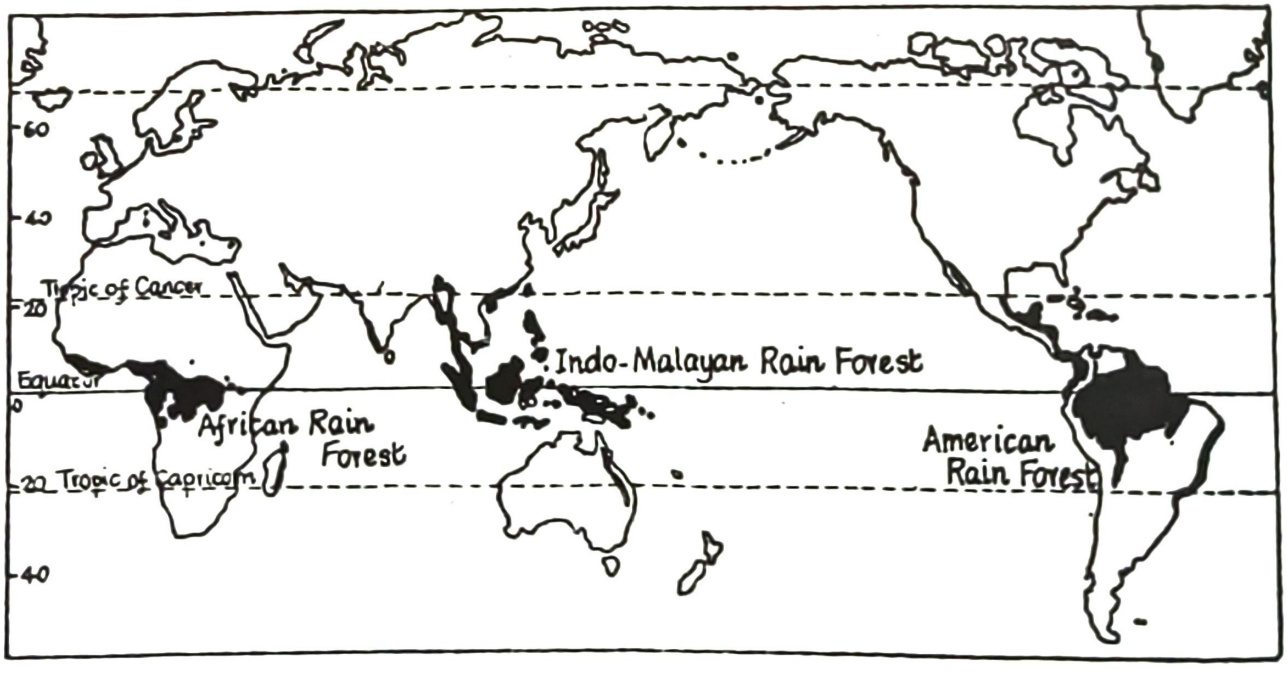
by John MacKinnon

For a naturalist or a zoologist it is a great privilege to live in Southeast Asia for here living conditions are more favorable than anywhere else on this planet. The forests grow more luxuriantly and show greater floral diversity than anywhere else and the variety of animal life matches that of the plants. Where else can we find startled tarsiers, haughty orang utans, unlikely gliding snakes and lizards. Only here can we watch the timid tapir and hear the joyful whooping of gibbons.

Many of the region's animals have the potential to be of great use to man. The wild cattle, swine and deer could one day contribute to domestic meat stocks. Powerful elephants and even orang utans can be useful in many projects. Their strength, intelligence and ability to reproduce gives them enormous advantages over petrol–powered machinery. Several of the macaque and gibbon species are already invaluable in medical research and the development of vaccines. Tigers and leopards enrich our lives with the thrill and inspiration they give us. Among the invertebrates can be found vast numbers of potential assistants in future pest and weed control by natural means. Every species will have something to teach us when we learn more about their properties. If there is any purpose behind the creation of such diversity it is surely not the wanton destruction of so many glorious species through the greed and indifference of one super–mammal, supposedly the most thoughtful and conscientious species of all. To lose the fauna of S.E. Asia would be a tragedy for mankind.

The threat of such a loss is clearly present and frighteningly immediate. The rich fauna representative of S.E. Asia is a rainforest fauna. It is the current overexploitation of rainforest that threatens faunal survival and because rainforest faunas are characterised by high species diversity but low population densities, the dangers of local and complete extinctions are heightened. If large blocks of rainforest can be saved, most of the fauna could be saved, otherwise it will certainly perish. Pass whatever game laws you may to control the hunting, capture or sale of wildlife but the wildlife is doomed if its habitat is not also protected. The fate of the fauna is inextricably tied to that of the flora and it is the whole rainforest ecosystem that we must concern ourselves with.

By clearing the forest you expose the thin soil to the sun, causing the organic matter to break down



Distribution of tropical rain forest (Whitmore, 1975)

quickly. Rain becomes less plentiful and more erratic. When rain does fall on the parched soil it erodes the land and unchecked flash floods descend on the lowland padi fields carrying not valuable humus but sand that impoverishes the land. After two or three years the cleared land is unable to sustain further agriculture, acid grass *Imperata cylindrica* moves in and the area looks more like a desert than a place where lush rainforest once stood. Look at the blang, the barren Karo highlands of North Sumatra to see what results are brought about by indiscriminate destruction of rainforest. Look at the Indian subcontinent where three thousand years of overexploitation and abuse has resulted in a land of thornscrub where 80% of the natural forest has been cleared but only 10% of the land supports agriculture. Look at the Fertile Crescent of North Africa, the granaries of the Roman empire, where centuries of deforestation and bad agricultural practices have resulted in ever–expanding deserts.

My plea for conserving the rainforest of S.E. Asia is not based on sentimentality but practicalities; it is not a question of placing the interests of wildlife against or above the interests of mankind. Nature conservation does not mean non–exploitation of nature, it merely means *careful* exploitation in ways that do not exhaust Nature's renewable resources. The long term optimal exploitation of nature and the survival of natural species are not incompatible programmes; they can both be accomplished together.

Rainforest must be viewed as a long–term renewable resource, not a once–only bonanza like a mineral or oil deposit. People in S.E. Asia depend upon the forest for their daily needs. They cannot afford to live in a forest–free environment.

Total protection must be given to the forest where it is needed to protect important catchment areas vital to irrigation schemes, to prevent devastating erosion of delicate soils or where there are particular local interests and natural values. The remaining forests should come under different categories of exploitation.

Some exploitation forests should be reserved for minor forest industries such as collecting of firewood, palm leaves for thatch, rattans, small poles for house–building, limited hunting and fishing. Other forests may come under heavier exploitation involving small–scale selective logging using animal traction methods, such as cattle and buffalos, and having planks sawed on forest platforms rather than dragged out whole, thus generally keeping forest destruction to a minimum. Both the ecological and socio–economic advantages of small disperse exploitation groups like this exceed those of big mechanical operations.

Only in large blocks of relatively flat forest on alluvial soils and where there is also a low population density, would large–scale mechanical logging be ecologically acceptable, and even here selective logging should be rigidly applied. Only where land is subsequently required for *permanent* agriculture can clearfelling be an acceptable form of forestry, and the soils upon which this is possible are actually rather scarce. Clearfelling followed by reafforestation is a sterile and unacceptable form of forestry which will eventually be shown to be not only ecologically unsound, but also economically disastrous.

The rainforest has other values besides its wealth of wildlife and these accrue on the side of the conservationist, making his case much stronger and far less emotional.

The evolutionary histories of the flowering plants and the animals whose lives are so intricately interwoven with them, stand recorded in the primeval rainforest, many still unread. It was the tropical rainforests that stimulated both Darwin and Wallace to recognise the mechanism by which Nature evolves through the means of natural selection; possibly the most significant scientific advance of the millenium. These same rainforests are still vital to the progressive development of our understanding of the nature of life.

Among the forests lie thousands of undiscovered drugs and compounds whose usefulness cannot even be guessed at. The crops and stocks of the future lie unrecognised and the DNA building blocks of the genetic architects to come are still waiting to be found. Future generations of mankind cannot afford to lose this heritage.

But apart from this, the vegetative productivity of the rainforest exceeds any other natural biotype and all but a few cultivated crops. It does so on soils that are too poor to support sustained agriculture and without any need of expensive fertilizers or pesticides. There is much we must learn from the rainforest, the secrets of such richness.

These are long–term arguments that scarcely enter into the economic calculations of land–use planners and Government policies but there is ample evidence that rainforest more than pays its way even now, by standing undisturbed. The extensive forest cover determines the very climate and environment of S.E. Asia. Rainforest protects the thin soil cover, controls the run–off of rain, cools the air temperature sufficiently to attract and hold rain–clouds, fixes carbon dioxide from the atmosphere and provides a regular flood of humas–rich deposits on which lowland agriculture depends. And all these services are free, requiring no expenditure in terms of human labour or resources. Add to these functions the benefits accruing from the small scale forest industries; the collection of rattan, damar, firewood; controlled

(Photo: T. Schultze–Westrum)

hunting and fishing; even low–level cropping of timber (well within the regenerative capabilities of the forest); the recreational, research, touristic, educational and aesthetic values of the rainforest. Realise that these items will be building up credits year after year while the capital value of the resource remains unused and then consider whether it really makes economic sense to chop the forest down with such obscene haste that there will be no recropping for a century, if at all, and the resulting environmental damage could be irreversible.

Only if forests are rotated at a reasonable cropping interval, probably 60–80 years, can a stable forest industry continue, and then only so long as the total area of forest is not allowed to shrink.

Present levels of deforestation are far too high. It is a tragedy that there are so few foresters sufficiently humble, honest and divorced from financial interest to see the need for reduced levels and gentler methods of extracting timber.

Too often, the fastest financial returns are sought from the forest resources, forgetting the long–term evaluations.

Forests that should be saved are being cut down. Forests that should be exploited slowly and carefully are being used with rash haste. Forests that should be selectively logged are being clear–felled, putting an enormous strain on overstretched reafforestation needs. Land is actually being cleared so that more profitable reafforestation programmes in the form of timber crops can be carried out while the large open areas in vital need of tree cover are left as grassland because they are less paying.

Many of the reasons for such bad forestry practices are because of weak patterns of control. Forest guarding and patrolling is very lax in most remote areas, particularly when the forest concerned is not productive i.e. temporarily unprofitable. Villagers exploit such control weaknesses by carving new ladangs from the forest and extracting timber and firewood on a small but very extensive scale. If the forest officers responsible for such areas are underpaid and themselves loosely controlled they may become party to these abuses and take their cut.

There is also an unfortunate tendency for Governments to parcel out responsibility for land to one particular department. Thus an area of forest may be placed under the Forest Department. It becomes exploited as best fits the interest of that department, even though the consequences of such

exploitation may have damaging effects on neighbouring agricultural or residential areas. A good deal of regionally disadvantageous logging occurs that would probably be prohibited if other departments had a larger say. The Forest Department may gain little advantage from protecting a protection forest, while the Agricultural department's interests in such protection may be very high. A multi–departmental approach to regional planning would be more effective.

Recommendations

1. People must be educated as to their need for and dependence upon rainforests. The basic information should be supplied by ecologists and bio–sociologists, foresters, economists and agriculturalists but the message should be spread by professional communicators, school teachers etc.
2. At higher levels of government, precise details need to be placed in front of the decision makers relevant to whatever plans they are considering. This information should be concise and pithy, preferably tabulated into easily assimilated facts and figures, lists of estimates and evaluations.
3. Scandalous and corrupt exploitation of resources should be exposed for what it is. Ultimately all governments depend upon their credibility. The more open to public inspection and evaluation their doings are, the better.
4. Recommendation should be made to governments that regional development should be planned on a multi–departmental basis.
5. The governments concerned must be made to realise the need for greater responsible control of their officers' actions. Departments can have the best superstructure possible but ultimately they depend upon the lowest rung on the ladder, the field officers who actually perform the job of protecting, guarding, licensing and seeing that the law is adhered to. At present these personnel are too few, underpaid, undertrained, underequipped, as well as unsupported and unsupervised by higher authority.

Summary

The great handicaps to the proper use of natural resources in S.E. Asia are ignorance, corruption and inefficiency. Only with widespread education as to the ecological needs of man for the rainforest can the interests of communities be properly served. Only when the self–interest groups can be eliminated from decision making can we expect true community interests to feature in land–use planning. Only when the conductors of the law are sufficiently controlled and supported can more sensible levels of forest use be effectively put into practice.

The expatriate scientific community has a large role to play in the production of ecologically relevant information about the man–forest relationship and in giving technical advice to governments about resource values and uses. It can do little more than comment on parts two and three of above prescribed sequence. These are changes which must come from within the countries concerned, though the first part of the sequence can do a lot to help generate the second two.

If all three conditions can be met we can perhaps look forward to the survival of most of the natural ecosystems of S.E. Asia. Most plant and animal species can still be safeguarded if sufficient areas of natural habitat remain under no or minimal disturbance. Checking the waseful abuses of rainforest is by far the most important step we can take for conservation in S.E. Asia.

NATURE CONSERVATION TRAINING SCHOOL

The much–needed Nature Conservation Training School opened on schedule in November 1978 with an initial course of 29 students drawn from personnel of the Directorate of Nature Conservation and the Directorate of Forestry Planning, plus a small number from Perum Perhutani, Forest Research Institute, Forestry Service and various universities. The school, which is located near Bogor at the Ministry of Agriculture Training Centre, Ciawi, is under the overall direction of Ir. H. Mochammad Duryat M.Sc., Director of the Training Centre, and will be partly funded by the Netherlands Government, including eventual provision of four Dutch instructors.

The school is intended primarily for training of intermediate level personnel, including Wardens or equivalent (PPA Kepala Seksi), and will give a basic 10–month course consisting of approximately 50 percent classroom instruction and 50 percent practical field–work. While initially only Indonesian students will be accepted, it is envisaged that the school could later be developed on a regional basis to serve other ASEAN countries as well.

from **Conservation Indonesia**, *Vol. 3, No. 1, Feb 1979*

TAMAN NEGARA

by Ken Rubeli

Taman Negara, encompassing 4343 sq.km., and presently the only declared National Park in West Malaysia, is attracting increasing numbers of visitors from both home and abroad every year. In 1976 just over 2000 people took the 60 km. trip up river to Park Headquarters at Kuala Tahan. Most stayed two or three days in the Park.

The Game Department of West Malaysia, administrator of Taman Negara since its inception in 1939, has steadily expanded facilities in the Park both in terms of visitor accommodation and nature-recreation amenities. Presently at Kuala Tahan there are four Rest House rooms and six chalets plus a low-cost hostel to house up to forty people. For the comfort-loving national tourist, a new Rest House has recently been built offering four air-conditioned first-class rooms.

The more down-to-earth visitor may choose from two basically-appointed lodges situated away from Park Headquarters at Ranger Posts, and two others upstream on tributary rivers. Alternatively there is total immersion in the jungle atmosphere at any number of campsites within the park.

Construction of twenty-eight additional rooms over the next four years will boost visitor accommodation at Park Headquarters to about 120 beds.

A network of approximately 32 kilometres of marked and sign-posted walking trails now radiates out from Kuala Tahan, connecting hill-top look-outs, swimming holes, salt-licks, and other points of interest. Four hides have been built for wildlife observation . The hides overlook natural salt-licks which attract seladang (gaur), tapir, sambar deer, barking deer, and wild pig. Tiger and elephant are present in healthy numbers in the Park, but while signs are common, sightings are infrequent.

Park authorities seek to discourage visitors from high expectations regarding wildlife sightings. The simple fact is that few visitors are prepared to make the necessary effort to locate and observe wildlife which includes rising at dawn, keeping on watch all night in a hide, walking quietly and refraining from chatter and patience, patience, patience!

Specific information about activities available to visitors in Taman Negara has been lacking in the past, but park staff are now proudly showing a comprehensive array of Information Sheets and Trail Guides available free to visitors. Gathering of material, preparation, and printing, has taken more than a year of work by the Park's public Relations and Development Officer.

One activity offered is a nine day return journey to Gunung Tahan (2,187 m.), the highest mountain in Peninsular Malaysia. This trek, arduous by any standards, entails three days' toil through the sapping heat and humidity of the lowlands to reach the foot of the mountain, followed by a 2,000 m. climb into the chilling contrast of 45 °F (7 °C) nights and rolling mists. The peak, and the plateau below it, offer superb scenery.

Of special interest to visitors is a limestone cave close to Kuala Tahan. Here visitors prepared to endure guano inches deep, can follow yellow markers through a series of small dark caverns, and observe bats roosting by the thousands, as well as other cave creatures.

Outboard-powered boats, chartered by the day, carry three or four passengers at a time along the Tembeling River which forms the southern boundary of the Park, or up jungle-canopied tributary streams flowing pure and clear from virgin catchments. Along walking trails, squirrels, white-handed gibbons, leaf–monkeys, and rich bird-life may be observed.

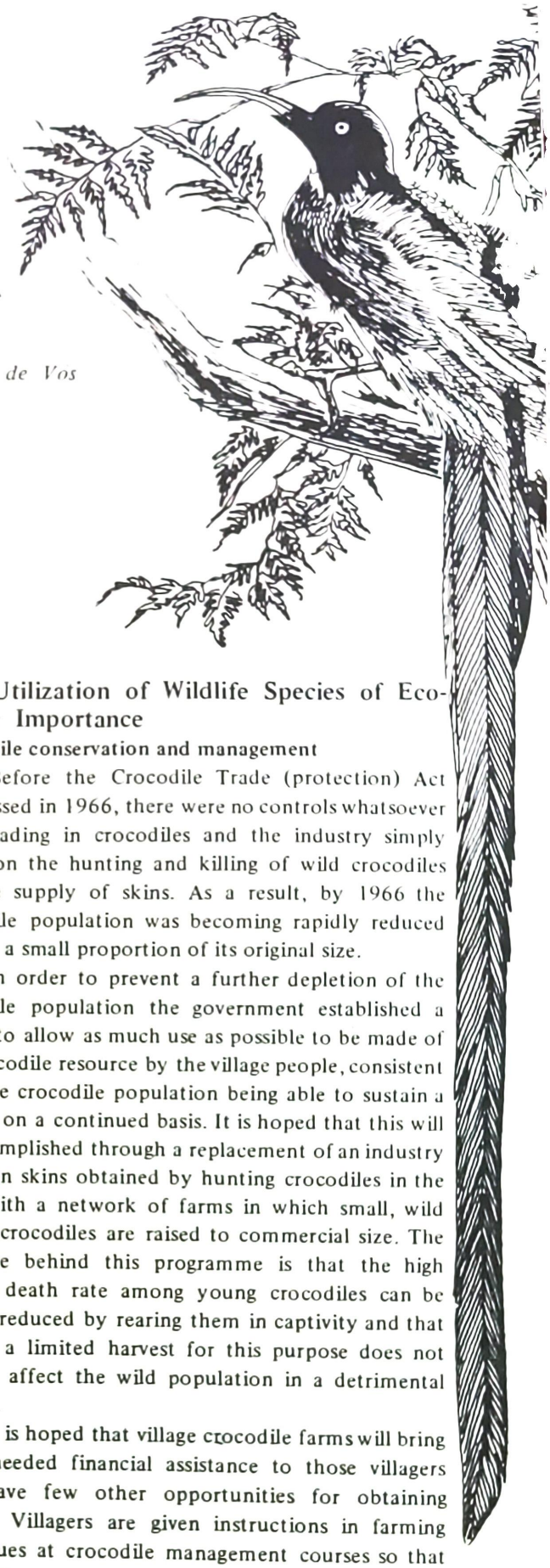
Steps are now being taken to prepare a Master Plan for Taman Negara, to establish the direction and extent of future development. It is hoped that at least two new areas can be zoned for the development of further educational and nature-recreational facilities. Large tracts of forest —— lowlands, midlands, and highlands —— will be set aside for restricted visitor use, for research purposes, and as wilderness areas.

Development *outside* Taman Negara, along the boundaries in each of the three States (Kelantan, Trengganu and Pahang) which the Park straddles, is fast increasing in tempo. In Kelantan, logging is now progressing into areas close to the Park, and land clearing is already under way for establishment of a large oil palm scheme which will abut on to Taman Negara. In Pahang State, logging operations are moving in to the area opposite Park Headquarters, and only after a protracted campaign in 1970 was logging within the Park itself averted.

Taman Negara, once green within a sea of green, is fast becoming an island. Inside the Park is concentrated much of the natural heritage of Malaysia, with facilities to make this accessible to visitors. Yet it seems that battles lie ahead, if the island is to be kept intact.

WILDLIFE CONSERVATION THROUGH UTILIZATION IN PAPUA NEW GUINEA

by A. de Vos



The title of this article may appear rather contradictory because in the past at least most utilization practices have resulted in the destruction rather than the conservation of wildlife. There are however many examples from other parts of the world which indicate that wildlife conservation based on utilization can be a sound practice.

All rural people of Papua New Guinea rely on wild resources on customarily owned land for their livlihood. Besides food, wildlife and its products have various other uses such as ornaments, medicine, weapons and so on in traditional Papuan New Guinean communities.

Papua New Guinea as a nation wants development. This inevitably means that coupled with a rapid increase in population, more land will be used for food and other purposes and that increasing pressure will be exerted on those parts of the country now little modified by man.

Until recently, most people in Papua New Guinea resorted to traditional conservation practices, including taboos on the use of certain species, limited exploitation of clan areas, etc., but with the introduction of modern firearms, nylon nets, etc., wildlife has become increasingly under stress.

For this reason the government has established an Environmental Policy with the objective that the ability of the environment to produce wildlife resources be maintained and where possible restored and improved.

One of the government's development strategies is maintaining and improving the quality of life in the village situation. Subsistence production is also emphasized. A high priority is given to food production – including the use of wildlife – and the government views development as a means of increasing prosperity economically, ecologically, socially and culturally in ways suitable to Papua New Guinea and her people.

The Utilization of Wildlife Species of Economic Importance

Crocodile conservation and management

Before the Crocodile Trade (protection) Act was passed in 1966, there were no controls whatsoever over trading in crocodiles and the industry simply relied on the hunting and killing of wild crocodiles for the supply of skins. As a result, by 1966 the crocodile population was becoming rapidly reduced to only a small proportion of its original size.

In order to prevent a further depletion of the crocodile population the government established a policy to allow as much use as possible to be made of the crocodile resource by the village people, consistent with the crocodile population being able to sustain a harvest on a continued basis. It is hoped that this will be accomplished through a replacement of an industry based on skins obtained by hunting crocodiles in the wild, with a network of farms in which small, wild caught crocodiles are raised to commercial size. The rationale behind this programme is that the high natural death rate among young crocodiles can be greatly reduced by rearing them in captivity and that in fact a limited harvest for this purpose does not have to affect the wild population in a detrimental fashion.

It is hoped that village crocodile farms will bring much needed financial assistance to those villagers who have few other opportunities for obtaining money. Villagers are given instructions in farming techniques at crocodile management courses so that they will acquire a better understanding of crocodile husbandry.

Birds of paradise

Birds of paradise have played an important role in ceremonial customs of the people and this role continues as strongly as ever in the rural areas. The long-term future of many species in Papua New Guinea is now in doubt as a result of the effects of material and socio-economic changes. The use of shot-guns, commercial exploitation of plumes and habitat destruction are among the major factors involved.

In order to prevent the further depletion of these beautiful birds, the government has set up a programme in which efforts are being made to avoid further serious losses in numbers, to preserve large populations of birds of paradise in selected reserves and to establish the wise use of these birds in close cooperation with the villagers concerned. It is essential to take into account the traditional land rights and usage as well as the ecological requirements of the birds.

To enlist the help of the people wildlife films will be shown in the villages, explaining the purpose and advantages of the programme. Unless the village people are fully involved and support bird of paradise conservation it is unlikely that significant numbers can be maintained.

The existing government policy is that birds of paradise may not be commercially exploited but should be preserved for use by the people in traditional and cultural ways. The export of plumes and live birds has been reduced to a minimum by strict enforcement of the law.

Cassowaries

Although cassowaries are important to the people of Papua New Guinea in most areas, their use varies from place to place. In most areas, they are hunted for their value as meat and for feathers, bones and toe nails. The feathers are used to decorate headdresses for traditional dances and the bones and nails to make tools and weapons.

It is only since the coming of Europeans that cassowaries have become a valuable item in the cash economy, because since armed fighting has become illegal, cassowaries have become important in settling disputes: they are difficult to obtain, and hence have a rarity value and play an important role in bartering to settle disputes. The cassowary has also become an essential component in bride price and compensation payments.

While traditionally this bird was hunted with bow and arrow or by trapping in pits or with a noose trap, these methods are being increasingly replaced by the use of the shot-gun and the steel-jaw trap. As a result the birds' existence is threatened in areas of heavy hunting.

The high value of cassowaries in the highlands has led to the development of an industry around the species. There are suppliers, raisers and traders of the birds, and finally consumers. As this is an industry without control it is unstable. For this reason the government has decided to initiate a management scheme with the cooperation of the landowners. This includes restrictions to traders and improved financial gains to raisers and suppliers.

Deer management and farming

Javan rusa deer *(Cervas timorensis)* spread into Papua New Guinea and now occur mainly in the Western Province with scattered herds in the Gulf and Central Provinces. The main herds occur on the Bala Plains in the Tonda Wildlife Management Area which was set up to prevent uncontrolled killing of deer. Until now deer have provided the main source of income for the people that live in and around this Wildlife Management Area from royalties from tourists on deer killed as game.

A government programme has been initiated to harvest deer on a large-scale basis and also to establish a deer farm. A crocodile farm could be set up in conjunction with a deer slaughtering plant to utilize the offal.

Megapodes

The eggs and the meat of megapodes have been traditionally used throughout Papua New Guinea but the species *Megapodius freyeinet* is particularly abundant in West New Britain where it is an important source of protein.

Insect farming and trading

Papua New Guinea has become a mecca for butterfly and insect collectors because of the variety, size and beauty its species. These insects constitute a resource which has considerable potential for development into village projects particularly in less developed areas, but which has not been fully explored.

Until 1968 there were no restrictions on the export of insects and a large scale export business existed, involving butterflies and beetles. In order to prevent a serious depletion in numbers seven of the more spectacular species of birdwing butterflies were declared protected in that year.

A programme has now been inaugurated by the government to assist interested villagers in the methods of collecting, farming and exporting unprotected butterflies and other insects to overseas dealers and collectors, to improve knowledge of insect farming and to establish a rational grading and marketing system for export. A villager who wants to diversify into profitable butterfly farming is encouraged to grow more of the food plants of both the larva and adult butterfly and then to harvest the pupae from the plants.

Beetle farming has not been attempted so far but many are collected, including the long-horned beetle *(Batocera wallacei)* which is attracted by the sap of the breadfruit tree.

Over 500 farmers and collectors are now engaged in insect farming and trading and they receive technical advice from Wildlife Officers. A marketing centre has been set up by government to assist these people.

Dugongs

Dugongs are of subsistence and cultural importance to the coastal people of Papua New Guinea. In recent years the number of dugong has declined greatly as a result of the introduction of modern equipment and methods of hunting, with the consequence of an increase in kills.

In order to halt a further diminution of this species it was declared protected in 1976 with the exception of traditional use by automatic citizens (native Papua New Guineans). This measure was necessary to restrict the catching of dugong with large nylon nets, and the sale of their meat in markets. Thus, utilization of the dugong has become restricted to the subsistence economy and taken out of the cash economy which has proved so disastrous for the dugong populations in other countries.

The Wildlife Division of the government is now collecting basic information on the basis of which conservation and management strategies can be developed.

Marine turtles

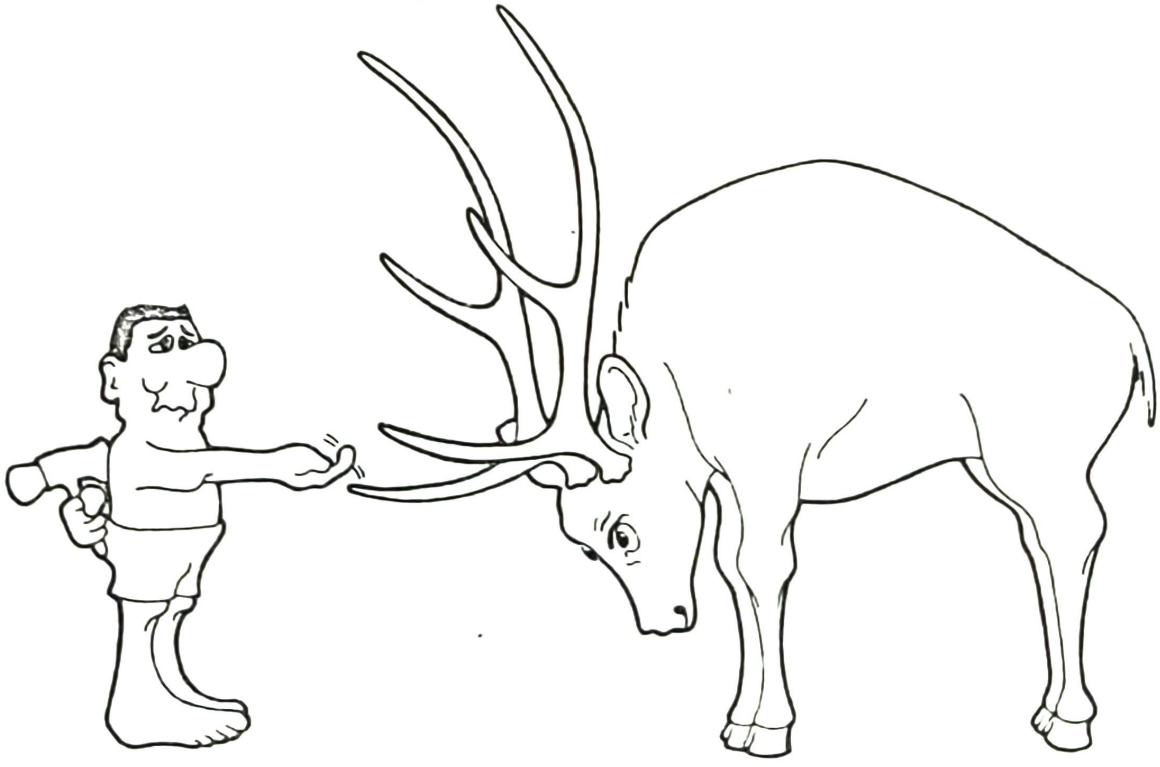
Six species of marine turtles are believed to occur in Papua New Guinea waters. Among these the Green *(Chelonia mydas)*, Leathery *(Dermochelys coriacea)*, Hawksbill *(Eretmochelys imbricata)*, and Ridley *(Lepidochelys olivacea)* are being exploited and have significant cultural and nutritional value for coastal people. In recent years many reports have been received expressing concern for a decline in their numbers as a result of a replacement of traditional ways and practices by modern killing methods.

Marine turtles are an important source of subsistence food because turtle meat has a high protein content. Also the sale of excess meat, eggs and shells at the local markets provide villagers with a small source of cash income.

It is believed that there are still fairly large populations of these turtles in Papua New Guinea waters but information is inadequate. A programme has been set up by government aimed at producing conservation and management strategies for marine turtles which will be appropriate to the indigenous people and consistent with their traditional practices and beliefs.

Successes and failures

The foregoing details about various species illustrates that in Papua New Guinea there are unique



possibilities for wildlife conservation through utilization and that the government is assisting the rural population through policy and management to make the best use of the wildlife resource on a sustained yield basis. The crocodile, megapode and insect rearing programmes have already been successful, but the dugong and marine turtle programmes are hardly beyond the stocktaking stage and no effective management procedures have been established. Unfortunately the cassowary rearing programme which was initiated with New Zealand technical assistance has largely failed. The main reason for this is that the indigenous people of Papua New Guinea are not accustomed to animal husbandry practices and are inclined to take care of captured animals on a casual basis only, which creates problems of undernourishment, increased disease and parasite incidence, etc. This has also proven to be a major stumbling block in the development of crocodile rearing at the village level.

Another problem is that the technical and extension staff now employed by the government are inadequately trained and that there is insufficient staff to do an effective job. For this reason there is a need for technical assistance such as that now offered by the UNDP/FAO project on assistance to the crocodile industry.

In view of the fact that villagers in many areas have expressed their desire to control hunting of wildlife and destruction of habitat on their clan or village land so that they, and future generations, could continue to enjoy, use, eat and earn money from this resource, there are definite signs of hope that improved management of wildlife under the control of government will lead to better conservation practices while utilization is continued as warranted.

The author is Project Manager for the UNDP/FAO Project on Assistance to the Crocodile Skin Industry.

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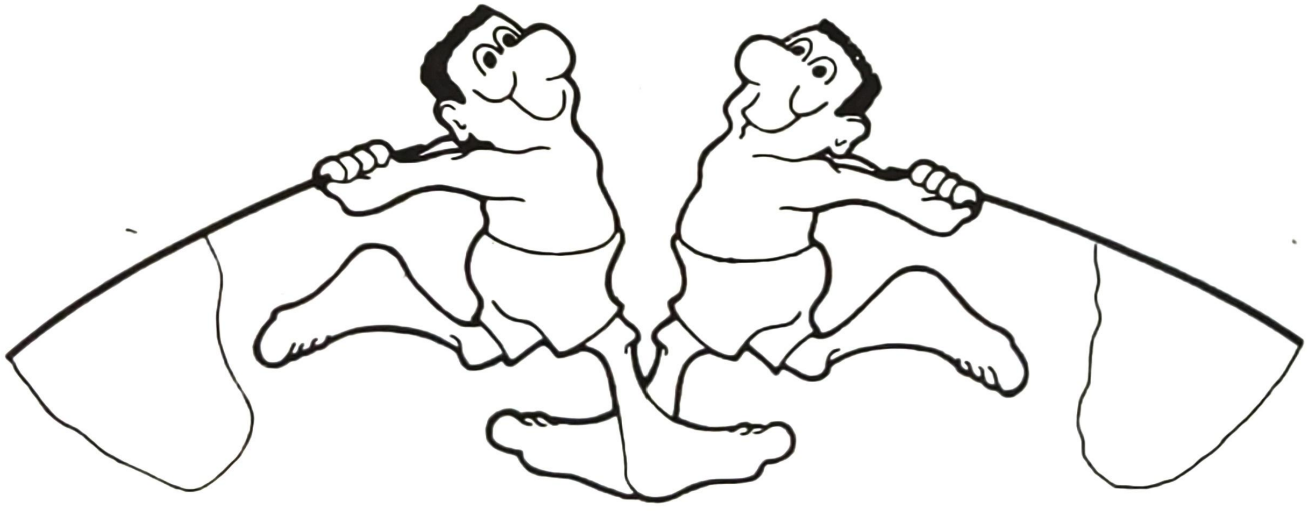


WESTERN SAMOA LAUNCHES A NATIONAL PARK PROGRAM

by Ian G. Trotman

In 1974 the government of Western Samoa passed legislation to provide for a National Parks and Reserves System. However, little progress was made until March, 1978, when approximately 7,000 acres (2800 ha) on the southern central portion of the island of Upolu were set aside as the first national park, O Le Pupu–Pu'e. This Samoan name means "The Cliffs–Mountain."

Unfortunately, over the intervening years progress had been limited for reasons which are well known to other developing nations, namely, a lack of expertise and trained staff, and inadequate financing for the purchase of land and park development. There was also the added complexity of land being held under customary ownership, that is, communally owned by a family but with the title held in trust by an elected chief (Matai). a common situation in the South Pacific. Although this has not been a problem in establishing O Le Pupu–Pu'e, since it lies on government–owned lands, the development of national parks on non–government lands needs to be reconciled to the question of customary ownership. For this reason it is hoped that the O Le Pupu–Pu'e National Park will serve as a demonstration area, and there by foster wider public and political support for the concept of national parks and conservation in general. This will not be an easy task in a largely subsistence society.

A report prepared in 1975 by the International Union for Conservation of Nature and Natural Resources (IUCN) and a United Nations Development Advisory Team (UNDAT) considerably assisted Western Samoa by outlining a basis for a system of national parks and reserves. Reservation of approximately 6 percent of the land area was proposed to provide permanent protection of all major ecosystems and for a range of historic sites for aesthetic, educational, cultural, economic and recreational purposes. Staffing requirements were outlined and the formation of a National Parks Authority was recommended. The latter recommendation has not been implemented as alternatives, such as a National Conservation Trust, are being considered.

In early 1977 responsibility for administering National Parks and Reserves was transferred to the Department of Agriculture and Forests. A reorganization of the Forestry Division enabled a small but enthusiastic staff to commence activities leading to the first park.

The skeletal staff now handling national parks and reserves work is headed by an Acting Superintendent who combines this responsibility with Forest Extension (encouraging public awareness of forest values and the planting of small scale woodlots). He has received valuable training under the regular International Training Course sponsored by the Australian Government. A national parks trainee is presently gaining field experience before going overseas, probably to New Zealand, for training as an information officer. A junior forest assistant, who will also be visiting New Zealand for training, completes the existing professional staff. However, approval recently has been received to double this number. A labor force of three caretakers and a fluctuating number of up to about 15 workers completes the local staff. All are assisted by one U.S. Peace Corps volunteer, a natural resources graduate. A senior park ranger from New Zealand will arrive early in 1979 to spearhead park development.

In this first whole year of operations a small budget of $WS 30,000 has been allocated. It is hoped this will increase to $WS 200,000 in 1979. Our aim for the next few years is to deliberately progress slowly by developing only one or two of each of several recommended classes of reserves so that they can serve as demonstration areas to arouse interest and support for the concept. There areas will also allow staff to get practical experience of operating in the local situation before trying to expand. Most initial areas would be on land controlled by the Government as legislation does not readily permit such use of customary communally owned land. It is hoped that as a

result of these demonstration areas there will be willingness to consider some form of dedication of lands for parks and reserves with the local people participating in management in a somewhat similar manner to the approach being used in Papua New Guinea.

Goals of the Park are to:1. Conserve a large representative area of the land forms, vegetation and wildlife in a largely unmodified state. 2. Conserve water supplies for current and future use. 3. Communicate to the public the concepts and values of the natural history of the country and their natural heritage, providing an outdoor classroom. 4. Provide tourist attactions containing features of outstanding interest and representation of the natural environment.

One of the largest parks likely to be established in Western Samoa, the O Le Pupu–Pu'e National Park contains a range of ecotypes found on Upolu. The park is buffered on one side by a block of State Forest being used for a reforestation project and on the other side by an experimental demonstration farm. Both are controlled by the Department of Agriculture and Forests.

Physiography

The park is bounded on the south by the cliffs of the "iron bound" coastline which were formed by the marine erosion of the relatively recent pahoehoe lava which poured over the existing coral reefs into deep water. Extending inland, the park continues to the highest point on the island, Mt. Fito, a cone situated on the central mountain range. The park is unique in including the only area on the south coast where three of the major volcanic formations from which the island is formed are found close togerher, with the consequent and varied range of soil types which have formed over them.

Geology

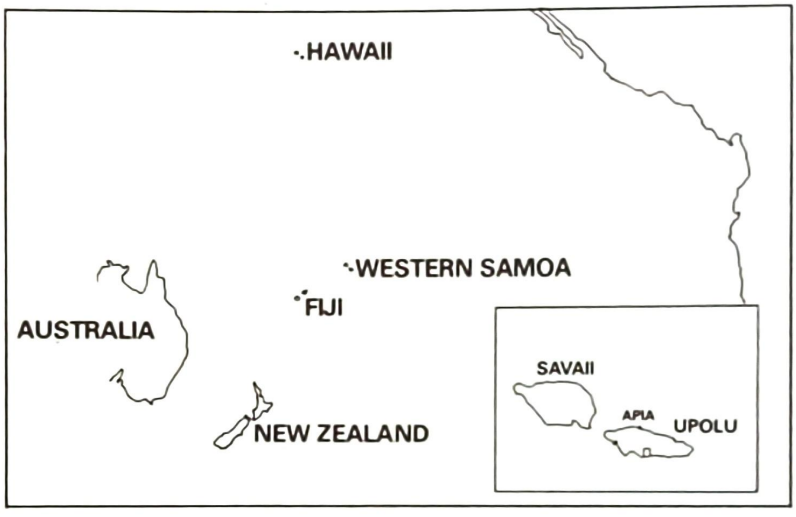
Western Samoa is wholly volcanic in origin. Six different periods of volcanism, ranging from Pliocene to recent, have occurred here.

The youngest volcanics within the park, the Puapua volcanics, began erupting when the sea level had risen to nearly its present position following the last glacial period.

An example of Puapua cinder cone (Mt.Fito) is found in the park and it is well preserved. On the costal lowlands the Puapua lava are low gradient, ropy pahoehoe flows.

Rocks from the oldest volcanic period, the Fagaloa, are also found in the park, as are Salani volcanics. Variations in the surface structures caused from these volcanics have resulted in some notable waterfalls in the nearby Togitogiga Recreation Reserve.

Although there are 90 different named soils in Western Samoa, they are mostly formed from basalts. Variations in soil types reflect the composition of the parent material.



Central Pacific location of Western Samoa, and the O Le Pupu–Pu'e National Park on Upolu Island

Vegetation

Near the coast the pahoehoe lava of the Puapua volcanics remains bare and grades back into a littoral belt of scrub, demonstrating the effect of salt wind shearing the coastal vegetation.

Continuing inland, the area is characterized by poor quality lowland forest. This is the only remnant of an extensive tract which spread along the south coast of Upolu before agricultural clearing. It is now restricted to the harsher edaphic sites of the Puapua volcanics.

At higher elevations in the park the foothill forest occurs on the rolling to moderately steep terrain, extending approximately from 750 to 1,800 ft. (228 m to 548 m). These foothill forests have a some-

what higher proportion of tree ferns, and there is greater growth of moss and lichen on tree trunks than is evident in lowland situations.

Many of the species prominent at lower elevations persist and may even be locally common in the higher elevations in the montane and cloud forest. The proportion of ground and tree ferns increases markedly on the upland plateaus and many of the trees are clothed in lichens, mosses and epiphytes. The largest trees in the canopy are often the same as those of the foothills. The montane cloud forest trees have an average height of about 80 feet (24 m).

Proposed Development

In the North along the central island mountain range the park includes an upland plateau flanked by deeply dissected canyons. This area is the only remaining tract of relatively inaccessible wilderness type high forest on the island of Upolu.

A UN sponsored survey by a team comprising a geologist, botanist and wildlife expert has just been completed, adding to the knowledge of the park. Their report, expected early in 1979, is eagerly awaited. The survey has revised the geological map, as it affects the park, by discovering that the Puapua lava actually erupted from Mt. Fito, following an indirect course to the coast. A long lava tunnel (1800 meters) which contains colonies of bats and swiftlets has been discovered. Forty two species of birds have been observed in the park along with three species of lizards, one previously unrecorded. The vegetation has also been described and related to the landforms. A series of excellent diagrams have been prepared showing the origin of geological features and currently active processes. Once the survey team's report is available, zoning will be considered but this is likely to be very simple, possibly involving a small central upland wilderness area, and a more intensive development zone around the main information center and headquarters. The bulk of the area would be left as protected natural environment.

The main visitor center will be located on the coastal road which bisects the park. This will provide information on the park as a whole. A second, small information center will be located on a penisula of bare lava and will contain information specific to that area, for example, on the nature of the lava and the littoral vegetation belt. These centers will encourage public understanding of the values contained within the park and will be very important for educational purposes.

Other developments completed include a nature trail around a portion of coast to the bare lava penisula Plants will be labelled and there will be stops at points of particular interest. Literature will be used to explain these features. A similar nature trail will eventually be developed to the lava cave. A trail from the coast to Mt. Fito is under constuction and will have a descriptive leaflet prepared on the landforms and vegetation through which the trail passes, together with an indication of wildlife likely to be seen. Information centers will contain display boards, a range of brochures and booklets, hopefully models, and eventually slide/tape shows. In the longer term we have visions of fostering cultural activities at the main center including Samoan singing, dancing and handicrafts. It may also be possible to encourage tours of the reforestation project and demonstration farm with the National Park as part of a more varied tourist package. Other ideas await publication of the survey team's report and the secondment of the senior park ranger to spearhead the development. At present our major limitation is likely to be adequate staff. We do not wish to risk damage to some of the major attractions by inadequate supervision. and until this is available such areas are likely to be opened to the public on a restricted basis only.

Western Samoa is fortunate in having a larger land mass than many of the other islands of the South Pacific. It is expected that the O Le Pupu–Pu'e National Park will be an important reserve in accord with the principles ennunciated in UNESCO's "Man and the Biosphere Programme." typifying islands of volcanic origin. The benefits should be of international and regional importance, reflecting a national asset of high social and educational value.

Tusitala Reserve–the burial place of Robert Louis Stevenson

Arising from a gift of land to the people of Western Samoa from descendants of Robert Louis Stevenson and his wife Fanny, the Administration of Western Samoa passed an Ordinance in 1958 setting aside a small area containing Stevenson's tomb as the Robert Louis Stevenson Memorial Reserve, and approximately 120 acres (48 ha) as the Mt. Vaea Scenic Reserve.

Following the establishment of a National Parks and Reserves Section within the Department of Agriculture and Forests, the Government brought these two Reserves into the System under the new name of the Tusitala Historic and Nature Reserve. Tusitala was the name given to Stevenson by Samoans and means the "Teller of Tales." At the same time, additional Government land was added to bring the area up to approximately 320 acres (129.5 ha).

The famous Scottish author, a frail man, travelled to many parts of the world seeking an area where he could live more comfortably with his poor health. After visiting various parts of the Pacific, he and his

wife Fanny arrived in Western Samoa in 1889. Charmed by the tranquility of the islands and the friendliness of the people, together with the considerable improvements to his health, they decided to buy land and build a house. Their plot of land was over 300 acres (121.5 ha) on the side of Mt. Vaea, which rises behind Apia, Samoa's capital and chief port. Waterfalls and streams tumbled down the hillside giving rise to the Samoan name Vailima, which means 'five streams'. This name was given to the Stevensons' elaborate home. This building with a number of additions forms the basis for what is now Government House. It was occupied by the Administrator during the period when Samoa was a New Zealand Trust Colony and since Independence it has been the Official Residence of the Head of State.

At first there was only a rough track up to Vailima but the local people laid a broad road and called it the "Road of Loving Hearts" in recognition of their devotion to Stevenson who helped them during a period of political unrest.

Stevenson died in December, 1894, and was buried on the summit of Mt. Vaea.

Eventually a large tomb was built over his grave, on the side of which was carved on a plaque the words of his immortal poem, "Requiem," which he had written 15 years before. It includes these famous lines:

Here he lies where he longed to be;
Home is the sailor, home from the sea,
And the hunter home from the hill.

Mt. Vaea, an outlier of the foothills rising to the central island mountain range, juts almost into the city of Apia. It is largely unmodified, except to the north where a few residences have been built overlooking the city. The mountain is covered by lowland and hill country forest, some of which was badly damaged by hurricanes in past years. Since the eastern faces of the mountain form part of a water catchment area, exotic trees were planted on the most severely damaged sites to protect the soil. With the increasing pressure of urbanization, some villages have unfortunately cleared parts of the land for food crops. An educational campaign has been undertaken to prevent further clearance and it is intended to restore forest to the reserve as the food crops mature.

Renovations so far undertaken include the upgrading of the track to the summit, the construction of a round house there for picnics, the provision of toilets and rubbish receptacles, the surveying and fencing of the public access to the reserve, the formation of a car park and the clearing up and improving of a swimming pool built into the stream flowing along the foot of Mt. Vaea. Development plans include the preparation of a map table at the summit, the formation of two or three trails to other parts of the reserve, the labelling of plants, the preparation of brochures and, in association with educational authorities, booklets which will describe the natural history of the reserve and encourage its use for outdoor education.

Recently the Head of State announced that a portion of the Vailima grounds would be linked with the Reserve and a forest aboretum for development as a botanical garden.

Currently, more than 150 people visit the area each month.

from **Parks**, *Jan.–Feb.–Mar. 1979*

Ian G. Trotman has just concluded a tour of duty in Western Samoa as the Chief Forest Officer in the Department of Agriculture and Forests. He was seconded to this position under the New Zealand Bilateral Aid Programme.

O Le Pupu–Pu'e National Park's iron bound coast was formed during the Puapua Volcanic period when lava buried the reef and plunged into deep water. Note the bare lava and sheared littoral shrub zone grading into forest.

(Photo: I.C. Trotman)

THE VALUE OF ROADSIDE VERGES TO WILDLIFE

by R.C. Anderson

Most of us suspect that roads may be 'bad' or detrimental to wildlife and in many ways we are right. However, if we view the countryside from an aeroplane the roads and the remnants of bush along the roads appear much like rivers, and again like rivers can be either 'corridors' or 'obstacles'. Railway and drainage easements may also have similar characteristics.

In this article I shall consider the relationships between roadside verges and wildlife and between roads and wildlife.

Roadside verges benefit wildlife in that they:–

(a) Offer migration and dispersion 'corridors' for birds, mammals and other wildlife.

(b) Provide breeding habitats for birds, mammals and other wildlife, and,

(c) Show travellers examples of the original bush and hence provide them with pleasant scenery and an appreciation of wildlife.

The presence of these 'corridors' of bush along roads is essential when some aquatic or terrestial insect, amphibians, reptiles, birds and mammals migrate during droughts or for other reasons. Although Australian birds do not generally migrate in such large numbers or over such long distances as do the birds of Europe and North America, certain species do disperse and migrate through bush and mountains. Hence, it is quite common for large numbers of birds to perform local and altitudinal migrations. Honey–eaters, for example, depend heavily on the flowering of various types of vegetation throughout the year.

If these 'corridors' are disrupted, in some cases it is due to excessive roadside maintenance. In others, planting of the inappropriate species of tree can result in a lack of suitable habitat for native animals and a resulting increase and the spread of locusts, rabbits and other vermin. Controlled burning along road reserves, for example, is a part of roadside maintenance but the frequency and the degree of burning should vary according to the different types of habitat. Roadside verges having natural stands of trees, shrubs, herbs and grasses along the roadside can be managed easier than those having only grass which has to be cut or burnt more frequently. Instead why not plant native shrubs and trees on roadside verges?

Should ever a standing dead tree or trunk be removed? Sometimes these trees harbour rabbits but they also provide nesting sites for many species of birds and mammals and I feel the latter would in most cases outweigh the use of these sites by rabbits or other vermin. In Britain, roadside verges, which form a large proportion of the country's bushland are considered an asset because they support about half the total number of animal species in that country.

Current thinking also considers that roads should have aesthetic appeal and for this reason some roadside verges are classified by the National Trust in Britain and by North America. Recently, the Land Conservation Council in Victoria commented on road reserves and recommended several guidelines regarding roadside uses proposed, including Highway Scenic Parks.

The three main detrimental effects of roads on wildlife are:–

(a) The isolation of plant and animal communities which varies with the width and nature of the road surface.

(b) The introduction of an imbalance into a natural community of plants and animals by modification of predator–prey and disease relationships.

(c) The destruction of wildlife by collision, habitat removal, soil erosion and other means.

A road wider than 20 m limits the movements of some small and medium sized mammals. This is detrimental because animal and plant communities cannot mix naturally as the road is an obstacle and an imbalance develops.

This illustrates why planting of appropriate vegetation on median strips and verges is beneficial.

The vegetation can markedly deteriorate if roads lead to areas where wildlife weren't able to move before. In some South African National Parks the construction of roadways has been found to disrupt wildlife habits i.e: where animals rest and where animals move to. The large prey mammals, e.g. antelope, tended to wander along the relatively dry roadside rather than in windswept fields. Similarly, lions, moved much more frequently along roadside reserves as it was attracted by the presence of prey and because of ease of movement along roads.

A study by the Commonwealth Scientific and Industrial Research Organization (C.S.I.R.O.) Division of Wildlife Research shows that traffic on roads kills relatively large numbers of wildlife, but of the wildlife killed in the study area none was of a rare or endangered species. The evidence from the study showed

Aeriel photo illustrating areas of forest along Road Reserves connecting larger areas of forest. (Photo: R.C. Anderson)

that the effect on the overall wildlife population was minimal. However, I suggest that the effect of each new minor or major road proposal on significant wildlife (i.e: rare or endangered) should be considered for an environment assessment for each area where road construction is being considered.

Another threat, perhaps as serious, is the build-up of lead and other heavy metals in roadside soils and vegetation. In soil and vegetaion along roadsides in the Sydney area levels of heavy metals were found to be as high as those found in certain roadsides in the United States. These levels could cause death or mutation of genetic stocks of both animals and plants. These metals may eventually spread through the soil to the water table. The effect of this on vegetation would probably be minimal, but animal species may be affected as they are more susceptible. The answers to this question remain to be examined.

In the final analysis, the complexity of the problem of roadways and their reserves and the inter-relationship to the wildlife and its habitat the solution to this problem is indicated by the following statement by R. J. Hamer, Esq., Premier, State of Victoria in 1971:

"It will never again be possible to plan for what is broadly called development without equal and sustained attention to the environment. Engineer, architect, ecologist and conservationist must sit down together, no major planning can be said to be complete unless all these elements are part".

from Victoria's Resources Vol. 19 No. 2.

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CONSERVATION OF LIONTAILED MACAQUE *(MACACA SILENIUS)* AND NILGIRI LANGUR *(PRESBYTIS JOHNII)*

by G.U. Kurup

The Liontailed Macaque and the Nilgiri Langur, the only black monkeys of India, are confined to the monsoon forests of the Western Ghat mountains lying along the western coast of Peninsular India. Due to sustained deforestation in the past owing to a variety of demands on these forests and consequent habitat modification, fragmentation and eventual elimination on one hand, and poaching pressure on the other, the status of these two species has been of increasing concern.

Following is a brief review of the status and the eco-biological factors of the two species in relation to their conservation. For more details Kurup (1975), (1977), (1978), Green and Minkowsky (1977) and Oates (1978) may be seen.

Liontailed Macaque

Distribution

Present range limits of the liontail macaque may be taken as from lat. 14° 15' N around Jog Falls in Shimoga District, Karnataka State to 8° 24' N at the southern extremity of Western Ghats. In the northern half of this range lying in Karnataka State, they are known from Agumbe, Bhavathi–Kundremukh and Sakalashpur Ghats. The population here, however, is sparse and the predominant liontail range actually lies south 11° 30' N latitude, in Kerala and Tamil Nadu States.

Eco–biological limiting factors

Liontails sink or sail with the state of shola (wet evergreen) forests to which they are ecologically confined and narrowly specialized. Although the diet is widely varied to be almost omnivorous, it is heavily weighted to be frugivorous. This makes its forage range quite wide to the extent of 5 km^2, with a core area of 300 ha. (Green and Minkowsky 1977) in the Kalakadu area. Here also they are said to be heavily dependent on *Cullenia* fruits although it may not be so elsewhere. Almost entirely arboreal, they require closed canopy and any interference gaps here could drastically restict their ranging. Road, clearings etc. not to speak of estates, unless bridged over by overhanging canopy could cut the home range and contiguous population into isolated demes, lessening viability. Biologically they are slow breeders and probably

Lion-tailed macaque (Photo: G.U. Kurup)

not long–lived. Males start breeding at five years and females are said to produce only two or three young during a time life. The breeding interval in captivity may extend to twenty months. In fact a low proportion of infants is a striking feature of the troops. All these factors militate against the survival of liontails.

Present status

The total liontail population is around 55 troops or say 800 individuals (15 mean troop strength), mainly distributed in Nilgiri Periyar Sanctuary and Agasthya with other troops found in Nilambur, Palghat hills, Nelliampathy Hills, Perambikulam, Panniyar and Karnataka State.

Throughout its range , there are only two major habitats capable of sustaining large populations of liontails and which appear even now to be sufficiently left undisturbed. One is the Amarmabalam – Silent Valley – Attapady forest in the Malabar region of Kerala below the Nilgiri massif. The other is down South in the combined areas of the present Mundanthurai and Kalakkadu sanctuaries in the Agasthya ranges in Tamil Nadu. In the remaining areas populations are largely of a remnant nature, but Nilambur, Panniyar–Santhampura, and Kallar valley regions could be considered as sub–major areas.

Conservation problems

Conversion and eventual elimination of evergreen forests are the most important problem for liontail survival. Cardamom plantations represent the chief form of shola conversion as the understorey is completely cleared. Even minor interferences alter the inherent characteristics of sholas. Clear felling and selection fellings in the past have occurred extensively for a variety of demands on the forests. This has led to the present fragmented state of many previously contiguous sholas. Major hydro–electric projects often submerge large areas of virgin sholas, which is about to happen in the Silent Valley area which comprises the best liontail areas. Poaching is another serious problem. Capture for live sale in the animal market had been considerable in the past, but has decreased to a trickle now.

Conservation measures

Now that the two major areas of habitats mentioned earlier are strictly protected what is further required should include the following (Kurup in press):

1. All major shola forests should be declared inviolable, free of all foresty operations.

2. Towards restoring the continuity of sholas, forest corridors should be developed between adjacent isolated sholas wherever feasible, if necessary by aforestation involving the food trees favoured by liontails.

3. When new roads are built they should not cut across the sholas but rather should circumvent them.

4. All sholas containing liontails should be treated as liontail reserves and a regular system of check posts, road bars etc. may be installed in the approaches.

5. Comparative ecological study of liontails should be carried out in a few more major habitat regions to learn their full range of conservation requisites.

6. Adequate publicity should be given locally around all liontail areas to educate the people on the need of its conservation.

Nilgiri Langur

Unlike the monohabitat liontail, the Nilgiri Langur is a multihabitat species ranging, in addition to the sholas, in the semi–evergreen and moist deciduous forests and even in higher montane temperate evergreen forests above 1,700 m in elevation. But unfortunately an unfounded reputation for possessing medicinal properties has been the bane of its survival. Nilgiri Langur status, however, is not as precarious as that of liontails and of late, the trend is certainly towards a reestablishment for which a lessening of hunting pressure is the biggest contributory factor.

Distribution

Nilgiri Langurs coexist with liontails throughout the area south of 11° 30' N lat. North of this however, its range extends only up to the Brahmagiri hills of Southern Coorg. Beyond this the Hanuman Langur *(Presbytis entellus)* replaces it completely, which the Hanuman langur has not been able to do in the south. While the distribution of Nilgiri Langur is shorter in longitudinal extent than that of liontails, its range is wider laterally and higher vertically. This is because they range into moist deciduous forests bordering either side of evergreen and also into altitudinally higher level temperate sholas above 1,700 m. They are now found in most of the Western Ghat forests south of Coorg.

Eco–biological limiting factors

Although the Nilgiri langur is a multi–habitat species there is some evidence to believe that a relatively constant volume of evergreen forest is necessary and that this evergreen fixation might be independent of food. (Horwich, 1973). In any case a number of evergreen trees form its important items of food, and the necessity of ranging in evergreens (or in riverine

forests) as part of its home range is a limiting factor. Further its relatively small home range makes them very vulnerable for hunting of which there is considerable pressure on them because of the local belief of its medicinal value. Its loud vocalizations also help the poachers in pinpointing their location.

Status

For a more detailed account of their status in different segments of Western Ghats see Kurup (1976). Generally it may stated that increased protection afforded especially in wild life sancturies had reversed the declining trend and has brought about a reestablishment of the population. However, the status is not satisfactory in Nilgiris and Palni hills due to extensive deforestation that has taken place in the past. Except in the Naduvattom Paikara area and shola forests of Mukirthy, Glenmorgan and Nilgiri peak areas, there are only isolated remnant troops which have little prospects of survival. In the remaining segments of the Western Ghats, they thrive well wherever they are afforded protection, and in particularly favourable areas like Anamalai sanctuary there has been an appreciable increase of the population. But generally in the Western portions of Kerala State, populations are still insecure due to relatively more hunting and poaching pressure.

Conservation measures

The Nilgiri langur is an especially adaptable species. Being folivorous there is always an abundance of food in any of its habitat areas. Therefore the most important step in its conservation is prevention of direct decimation, by poaching. As it is a congener with liontails, the conservation measures outlined for liontails should adequately safeguard the interests of Nilgiri langurs also especially in the matter of habitat preservation. It will do well to provide enough publicity to refute the myth of its medicinal value. In short, habitat preservation, and also restoration wherever habitats have been tampered with together with protective measures to prevent direct decimation by poaching are all that may be necessary for the reestablishment of both the Nilgiri Langur and the Liontailed Macaque.

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Varanus komodoensis (Photo: Kuper)

RESEARCH ON MONITOR LIZARDS

by Dr. Walter Auffenberg

Gray's Monitor

In 1845 Gray described *Uranus ornatus*, a new species of monitor lizard from an unknown locality in the Philippine Islands, based on a juvenile specimen in the British Museum. In 1885 the name was changed to *Varanus grayi*. No additional specimens of this attractive monitor came to light until almost 100 years later when Mertens (1942) described the skull of an adult monitor lizard from Luzon that he assigned to this species. This specimen suggested unusual feeding habits, for its teeth were very blunt--unlike the sharp, compressed teeth of most monitors. Furthermore, the skull proved the species attained a total length of over one meter, and that it occurred on at least Luzon Island.

These two specimens and their accompanying data constituted our total knowledge of *V. grayi* until late 1974, when I located a specimen (previously misidentified) in the National Museum of Natural History (Smithsonian Institution). This, the third individual to come to light in 130 years, is the first complete adult; color pattern and proportions of a mature specimen are now available (Auffenberg, 1976). More importantly, this specimen provided the first important clue to its distribution.

In 1976, funded by the New York Zoological Society and World Wildlife Fund, I investigated a number of localities in the Philippines and discovered several viable populations of this rare monitor lizard in southern Luzon. The results of that study (Auffenberg, In Press) showed that the species: (1) is clearly extent; (2) occurs over a reasonably wide area in southern Luzon; (3) is restricted to remaining primary diptocarp forest; (4) is largely arboreal, a life style for which it is highly adapted; and (5) is largely frugivorous, feeding on the fruits of several palm and fig species (a peculiar feeding strategy in an otherwise completely carnivorous family). While much was learned regarding this large (to 1.5 m) arboreal reptile, only the rudiments of its behavioral ecology are now clear. Its distributional limits are probably not yet known, for the habitat extends much beyond the presently determined range. Additional data on its ecology, relative density, and prospects for survival will be collected. Additional information is also needed on its arboreal life style, for this adaptive zone in monitors has remained completely unstudied. Of primary importance in this regard are its feeding behavior and activity patterns. Other arboreal monitors also occur in Southeast Asia (*V. rudicollis*, *V. dumerili*, etc.). These too are poorly understood, and readers of the TIGER PAPER are requested to send any pertinent information on the arboreal habits of monitor lizards to the writer.

Water Monitor

Research on the feeding strategies of water monitors is continuing in several areas in Asia. This

work was first conceived in 1972 as a result of my studies of the Komodo monitor *(Varanus komodoensis)* (Affenberg, 1978, and earlier papers). These studies showed that these monitors are the only living reptiles, other than turtles, that cut their food into sections before swallowing it. Their efficiency in this behavior is related to their compressed, sharp, serrated teeth, large mass (to about 50 kg), and great strength.

With the exception of the large snakes, waste is lower for the Komodo monitor (ca 12%) than in any other large carnivorous vertebrate. Bones, hooves, almost everything is devoured. Their prodigious appetite, high feeding rate, and low waste are all important factors in reducing interspecific competition for carrion. Oras probably share less carrion with other species than any other large scavenger.

It is now clear that the predatory activities of *V. komodoensis* fall into three main categories reflecting predator sizes: (1) hatchlings that feed exclusively on small animals (insects and small lizards found under bark, in crevices of stumps, and in the grass); (2) small to medium-sized monitors that feed largely on rodents and birds normally obtained on, or under the ground (in burrows, rock piles, etc.); and (3) large monitors that may feed on animals as large, or larger than themselves. Prey are located by both sight and scent and obtained through both stealth and surprise along established game trails and in thickets. Most important is that large individuals may successfully attack prey animals up to 20 times their own mass, sometimes as large as Sunda Sambar Deer *(Cervus timorensis)* and water buffalo *(Bos bubalis)*. The results of these studies are to be published later this year by the University of Florida Press.

Because the Komodo monitor is rigidly protected by law and its population numbers are fairly low, it was not a good species with which to continue work on monitor lizard feeding strategies. For this reason my research has shifted to the non-protected water monitor *(Varanus salvator)*. This species is easily maintained in captivity, where detailed studies are currently being conducted in stalking, attack, and kill techniques.

What is additionally needed is an in-depth study of feeding in the wild. The species is avidly hunted for its leather and meat, and thousands of stomachs containing data of great value are discarded yearly. I would be exceedingly interested in obtaining preserved viscera of this species (my expense) and, more importantly, am seeking the assistance of one or more individuals with whom I might collaborate on a publishable project in which these persons would supply my laboratory with preserved viscera (obtained from commercial trappers?) on a regular basis for one year. Please contact me if interested.

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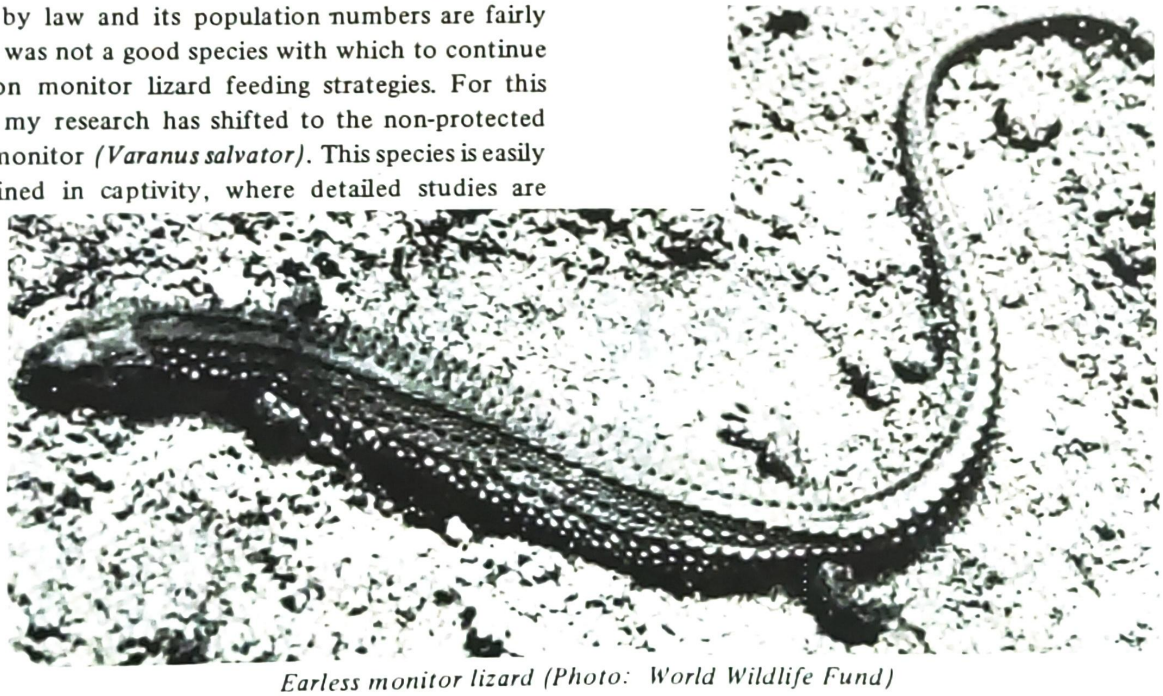


Earless monitor lizard (Photo: World Wildlife Fund)

(Photo: Ranjitsinh)

COAST CONSERVATION

by S.R. Amerasinghe

Introduction

Since the earliest times the interface of land and sea has increasingly nurtured and shaped a developing civilization. The coastal zone has been subject to attack by wind, wave and tide from the beginning of time, but its biggest enemy has been man. By man's demand for more energy, more food, more recreation, more landing places to bring ashore the resources of the sea, more ports for the import and export of goods and a host of similar activities, the coastal zone is under severe pressure and the very area which is vital for the well being of man is itself placed in danger. The coastal areas support more than 50% of Sri Lanka's population. Increasing population concentrations in these areas in the future will increase the environmental stresses already perceived, Demands on coastal resources consist of (1) *Sea ports* and Commerce providing for port facilities, trade, industry and oil wells (2) *Commercial development* which includes beach resorts, fishery harbours for mooring and repair of fishing vessels and facilities for processing fish (3) *Waste* disposal for sewage outfalls and chemically polluted inland waterways (4) *Brine intakes* for salterns (5) *Mineral extraction* for commercial purposes (6) *Public access* and transportation (7) *Recreation* for which clean beaches and warm unpolluted coastal waters are essential ingredients (8) *Natural resources* contributing to productive areas for marine life where the total environment needs conservation (9) *Residential development* for private dwellings and (10) *Coastal protection* to hold the diminishing frontiers from the ravages of the sea and the destructive activity of man. It would follow therefore, that the coastal zone cannot be treated in isolation but needs to be perceived as a part of the total environment. There is no doubt that an island eco–system cannot neglect the conservation of the coastal environment. In this context the effective and speedy conservation of Sri Lanka's fragile coastal zone cannot be postponed any longer, although degradation of the coastal environment was tolerated hitherto by the national planning process.

Background

In the last decade substantial investment has been made on actively located areas within the coastal zone. For example, about Rs. 350 million has been invested in the beach–oriented hotel industry, about Rs. 120 million in the provision of fishery harbours and shore facilities, about Rs. 50 million in port development and about Rs. 15 million in the development of salterns. In contrast, during the same period, little or no investment was made on conserving the very area vital to support this development. The government has now established a separate organization within the Ministry of Fisheries from January 1978, for the preservation, restoration and development of the national resources of the coastal zone.

Coastal areas been subject to considerable environmental degradation due to erosion, pollution, unplanned exploitation of coastal resources, and ad–

hoc coastal schemes of work usually located without resolution of use conflicts. Some factors contributing to such degradation consist of adverse sea conditions, reef destruction, sewage and industrial effluent discharge, coral and sand mining, poorly designed harbours and estuary outfalls, ad–hoc coast protection structures, disposal of dredged soil in near shore areas, off shore discharge of oil from bilge tanks of ships, the dynamiting of fish, and high density use of beach resources for the tourist industry. In particular, reef destruction is caused by removal of reef material for commercial purposes, sediment settlement on corals, the effect of sewage and industrial effluent on reef communities, and the accelerated run–off of fresh water during floods.

Erosion has caused parts of the Hikkaduwa coast to retreat inland by about 1000 feet in the last fifty years representing a loss of over Rs. 25 million of land value alone along a stretch of 2 miles of coast–line. With respect to coral mining it is estimated that a quantity of coral in excess of 75,000 tons per year is removed from the coastal zone and a quantity of over 300,000 cu.yds. of sand is removed from the south–west coast alone. The lime production industry with a turnover of over Rs. 100 million per year needs to be carefully planned in order to ensure the availability of lime for the building of industry, whilst at the same time safeguarding the natural defences from the ravages of the sea. The location, assessment and extraction of lime supplies from non–traditional areas and restriction of the extraction of sand to outfalls, lagoons and selected off–shore areas are an urgent necessity.

Realising the need for a planned programme of coast conservation, the Government initiated action in 1972 to establish a separate organisation for this purpose and to formulate necessary legislation. As a consequence, a limited training programme of personnel was undertaken since then, a Coastal Engineering Research Centre was established in 1975, and new legislation presented in the N.S.A. in 1976. Prorogation and subsequent dissolution of Parliament precluded the approval of this legislation.

Present Status

Positive steps for a planned programme of Coast Conservation were taken in November 1977 with the decision to establish a Division of Coast Conservation in the Ministry of Fisheries from January 1978. Through immediate follow–up action, the services of an expert in Environmental Law were obtained in February 1978 for re–drafting the Coast Conservation Bill. This new Law is expected to be presented in Parliament shortly, Additionally, the new policy encompasses consideration of the total coastal environment.

To achieve the aims of this programme, the Coast Conservation Division is structured to provide for Coastal Research, Coastal Works and Coastal Resource Development. Coastal Engineering research and consultancy on coastal problems for the state and private sectors would be provided by the Coastal Engineering Research Centre, whilst the design and construction of coast protection structures on an expanded scale are to be undertaken by the Coastal Works Unit. The Coastal Resource Development Unit will be responsible for the planned development of the coastal zone and in particular the implementation of the Coast Conservation Law. For this purpose, surveys and studies would be required to assess present coral mining and sand mining activity and the location of these material sources in alternative areas, for preparation of a coastal resource inventory, to assess the environmental impact of effluent discharge, reef destruction and beach pollution on the coastal zone, and to conduct a socio–economic survey of persons who earn their living by engaging in activity contributing to degradation of the coastal environment. The initial phase of the new programme of Coast Conservation is directed to infra–structure development capable of meeting the needs of a comprehensive programme of Coast Conservation in the future, whilst at the same time undertaking limited conservation work within the present organizational resource potential.

Legislation

Legislation for sea–shore protection is contained in Part VII of the Crown Lands Ordinance. This legislation merely provides for the granting of permits for developments affecting the fore–shore and prohibiting and regulating by license the removal of material from the foreshore. Past experience indicated that these provisions were inadequate to deal with the rapidly increasing demands for coast conservation. It was therefore decided to draft separate legislation for this purpose with the repeal of the relevant sections of the Crown Lands Ordinance. With this in view draft legislation was presented in the N.S.A. in October 1976 but could not be taken up due to prorogation and subsequent dissolution of Parliament. When the position was reviewed in 1977, it was decided to re–draft this Law to take into account the requirements of the total coastal environment. It was found that there existed a number of other Laws which had some concern over coastal development under relevant ordinances, viz. (1) Local authorities had the power to control developments in the coastal zone, (2) the Department of Town & Country Planning prepared land use plans for a number of coastal areas, (3) beach

(Photo S. Bhaskar)

–fronted tourist hotels needed the approval of the Ceylon Tourist Board, (4) factories were subject to the licensing jurisdiction of the Ministry of Industries & Scientific Affairs as well as the Ministry of Labour, (5) the construction of sewer outfalls were regulated by the Water Supply & Drainage Board, (6) prospecting and mining in the coastal zone were under the control of the Geological Survey Dept., (7) other developments were within the purview of the Colombo Port Commission, Ceylon Fishery Harbours Corporation and related organizations. In the drafting of the new Coast Conservation Law therefore, provision had to be made for suitable amendments to these Ordinances. The new law was drafted to provide for the following requirements:–(1) The new act should facilitate comprehensive Coastal Zone Management and not merely 'Coast Conservation', (2) The legislation should establish a comprehensive coastal zone planning mechanism, (3) The legislation should address itself to the social consequences of better coastal management, (4) The new bill should define "Coastal Zone" more broadly than the 1976 Bill. Provision has now been made for this zone to extend 2 Km seawards of the foreshore and 300m landward of the foreshore, (5) the new Bill should include an appropriate environmental impact assessment provision, (6) A Contingency Plan is needed in order to protect the coast from threats of major oil spill catastrophes. It was decided that the proper place for such a plan requirement is in the new marine pollution legislation being drafted in the Ministry of Foreign Affairs, (7) the new legislation should ensure the proper coordination of all Government activities in the coastal zone, (8) An increasing need to control coastal pollution, including river borne pollution carried to the coast from inland sources It was felt that this could be met through a mechanism whereby the Director of Coast Conservation notifies the appropriate Authority that pollution from an inland source is adversely affecting coastal waters and which requires the appropriate authority to take remedial action. This is even more important today, now that industrialization is to be encouraged on a much larger scale through the development of a free trade zone.

This new Law is now in the final stages of drafting for presentation in Parliament.

Conclusion

There is today a greater awareness of the environment than in the past, and it is hoped that concerned organizations, individuals and the Government would make a concerted effort to preserve, restore and improve the coastal environment for this and succeeding generations. To achieve this it is necessary, apart from government inputs, to obtain the active participation of coastal dwellers through a publicity and propaganda campaign to increase public awareness of the consequences of coastal environmental degradation. Success in this regard could only be achieved through the cooperation of related governmental institutes and private organizations, bearing in mind that the coastal environment is only a part of the country's total environment.

The author is Director, Coast Conservation, Ministry of Fisheries, Sri Lanka.

from **Loris**, *Vol XIV, No. 6 Dec. 1978*

(Photo: Ranjitsinh)

KANGAROOS

by T.J. Dawson

The conclusion of **Kangaroos**, *the first part of which was published in TIGERPAPER Vol VI: No 2–3.*

Why did hopping come into existence at all? The answer may lie in a conservative or perhaps primitive marsupial characteristic. For many years one of the factors that was thought to support the notion that kangaroos are primitive was the reported low metabolic rate and the low and fluctuating body temperature of marsupials in general. The basal metabolism of kangaroos and other marsupials is only about 70 percent of that of advanced placentals. Their body temperature too is slightly lower, 35.5 to 36.5 degrees Celsius (96 to 98 degrees Fahrenheit). They do, however, maintain a constant temperature level.

How can a low metabolic rate be reconciled with energetic hopping? Here two aspects of locomotion must be considered. One is maximum sustained speed for escaping danger. The other is economy in long-distance travel. The investigations by Taylor and his co-workers suggest that the costs of quadrupedal locomotion are more or less fixed. Maximum sustained energy consumption may be estimated from maximum oxygen uptake, which in turn appears to be related in some way to basal metabolism. Since marsupials have a low metabolic rate , it is possible that they have a low maximum energy output and consequently a reduced potential for speed of locomotion. The bipedal hopping of kangaroos and other macropodids could be a mechanism that helps to overcome this limitation. Also important for a metabolically limited animal, particularly for a kangaroo ranging over the semiarid interior of Australia, would be economy in long-distance travel.

Past assumptions about the kangaroo's limited ability to regulate its body temperature were based not only on the slightly lower body temperatures of marsupials but also on observations of a kangaroo behavioral trait: thermoregulatory licking. When kangaroos are chased on hot days, they occasionally stop hopping and lick themselves, particularly on the forelegs. Because licking has been generally accepted as a primitive mode of cooling, this behavior helped

"From 'Kangaroos', by T.J. Dawson. Copyright (c) 1977 by Scientific American, Inc. All rights reserved."

to sustain the notion that kangaroos cannot maintain a constant body temperature. Such a view would have been difficult to hold if those who held it had ever observed desert kangaroos such as the red kangaroo in their natural habitat.

It is hard to conceive of an inefficient temperature regulator spending long summer days in the sparse shade of a small desert tree when the air temperature can be in excess of 45 degrees Celsius (113 degrees Fahrenheit) and the radiation heat load makes the effective environmental temperature even higher. It has been found that far from being inefficient these kangaroos have possibly the most efficient and best organized thermoregulatory defense against overheating to be found in any mammal. Kangaroos not only lick their forelimbs during heat stress but also pant and sweat. The interrelation of these different methods of evaporative heat dissipation is seen only during exercise. When the kangaroo is resting, it dissipates heat primarily by panting; it does not sweat while resting, but under severe heat load it may lick its forelimbs.

The kangaroo's licking behavior was long a puzzle to my colleagues and me because the forelimb area usually licked is small. It seemed that the overall heat-dissipation benefit would be doubtful in view of certain possible disadvantages. Probably more in frustration than for any other reason we undertook an examination of the blood supply to the forelimbs. Injecting the blood vessels in the forelimbs of a dead kangaroo with liquid latex, we found that there was a dense and intricate network of superficial blood vessels in the region the animals usually lick. Further study revealed that during heat stress the blood flow to the region is greatly increased. The forelimb region is thus a site of significant heat transfer. Indeed, by spreading saliva on their forelimbs kangaroos may well be making the most efficient use possible of an overflow of fluid from their respiratory system, the principal site of evaporative heat dissipation in resting animals.

The pattern of heat loss in exercising kangaroos is very different from that in animals at rest. The reason is that exercising kangaroos sweat. Early in the course of our investigations it was suggested that sweating replaced panting during exercise because panting is not possible when the animal is exercising. We soon realized, however, that evaporation from the respiratory system is still highly significant during exercise because when the animal is exercising, water loss from these surfaces is greatly increased. In fact, the increase raises respiratory evaporation well above the levels the animal achieves by panting when it is at rest. This increased respiratory ventilation is probably primarily in response to the increased demand for oxygen during exercise and is therefore probably limited by the level of oxygen intake. Body sweating, then, appears to bring into play an additional surface area for further evaporative heat loss. Licking is not possible when the animal is hopping, although hopping kangaroos do stop occasionally and spread saliva on their forelimbs. Licking after exercise seems to assist the rapid return to normal body temperature.

An aspect of this picture that sets kangaroos apart from other mammals is that sweating stops as soon as a kangaroo stops exercising, even when its body temperature is elevated and it is panting and licking its forelimbs. Other mammals capable of sustained exercise, such as horses and men, not only sweat to dissipate heat when they are exercising but also sweat to dissipate it when they are at rest. A few mammals, such as cattle, sheep and other bovids, sweat and pant simultaneously. What does the kangaroo achieve by ceasing to sweat when it is at rest and starting to pant? The answer lies in water economy. An animal that lives in an arid environment must husband its body water, and water is better conserved when it is evaporated from the respiratory tract than when it is evaporated from the skin. Evaporation from the skin results in a lowered surface temperature, which leads in turn to a greater inflow of heat from the environment and the utilization of additional water to eliminate the additional heat. Panting, of course, does not lower the body surface temperature.

On a very hot summer day the red kangaroo is an example of an animal doing the most it can to both regulate its body temperature and conserve its water. When the temperature is higher than 45 degrees C., the red kangaroo does not lie down in the shade but stands hunched, thus presenting the smallest amount of surface area for the uptake of heat from the environment. The animal's dense fur provides an almost ideal insulation against the ambient heat. To further minimize the exposure of surface area to heat radiation the kangaroo's long, thick tail is pulled between its legs. The tail too has a complex network of superficial blood vessels that are involved in heat dissipation, but when conditions favor heat flow into the body, this system is apparently nonfunctional.

One stratagem for conserving water under arid conditions that has not evolved among kangaroos is the ability to let the body temperature rise during the day. The oryx, a ruminant of Africa and the Middle East, has a special arrangement of blood vessels in the base of the brain that allows the brain to be maintained at a tolerable temperature even when the temperature of the rest of the body rises as high as 46 degrees C. (115 degrees F.). Camels presumably have a similar arrangement. Hence both of these desert animals are able to store heat, which they can then

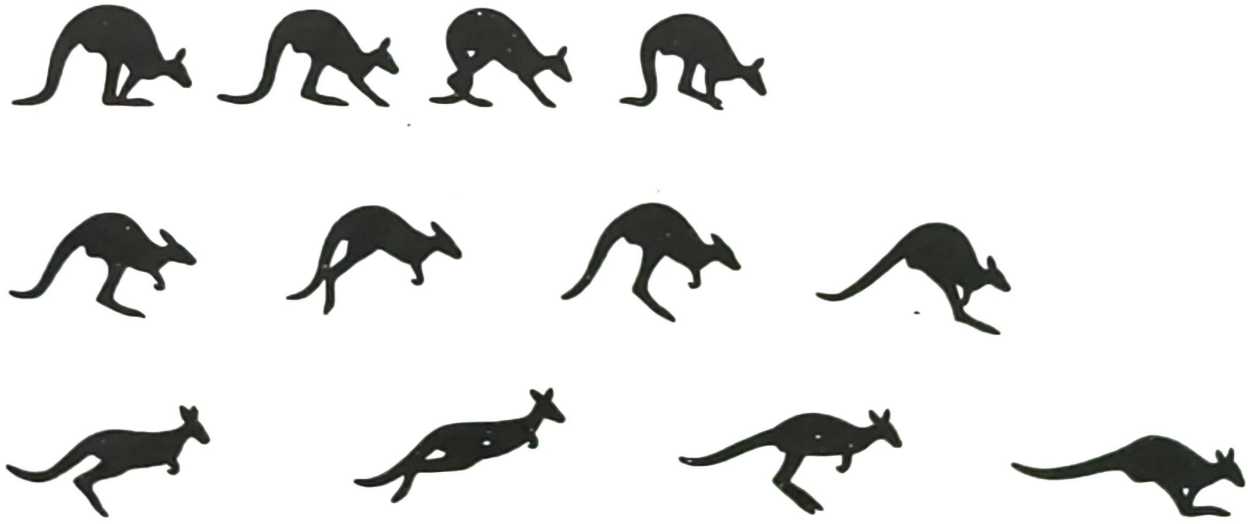
dissipate in the cool of the evening without expending water in evaporative cooling. Kangaroos do not have this vascular arrangement. Under conditions of heat stress and dehydration, however, the kangaroo lowers its temperature overnight, so that it can start the next day with its body temperature from two to four degrees below the normal level.

As a result of these combined adaptations for water economy the minimum water requirements of kangaroos are similar to those of the desert ungulates of Africa. Field studies indicate that arid-zone kangaroos turn over only a fourth of the water needed by sheep and wild goats. The oryx is completely independent of drinking water; it can get the water it needs from the plants it eats and from the oxidation of foodstuff. The kangaroo, like the camel, does need to drink occasionally under severe heat conditions.

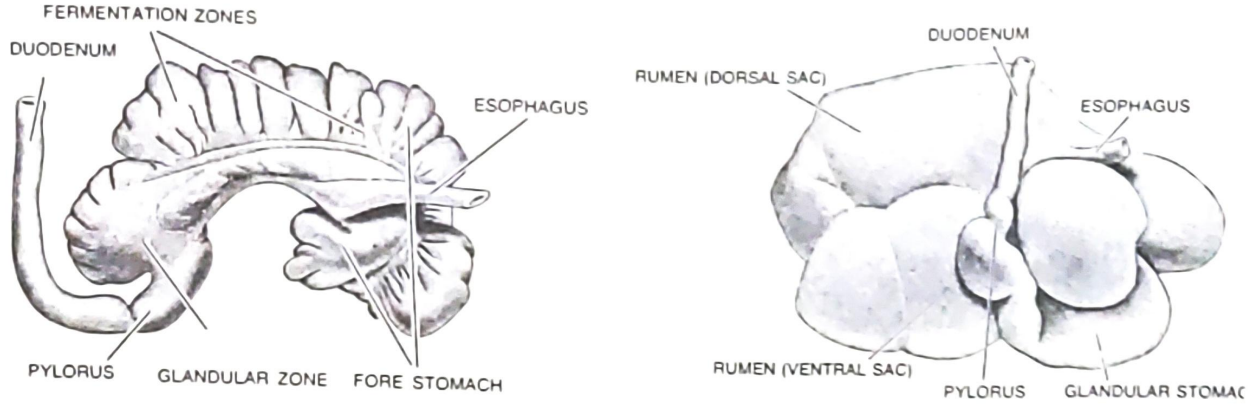
The persistent notion of primitiveness colors many perceptions of the physiology of marsupials. Consider the fact that the kidney of the arid-zone kangaroo has concentrating abilities superior to those of the kidney in comparable placental mammals. This should not really surprise anyone; the fundamental characteristics of the mammalian kidney appear to be very old. Even monotremes have a good kidney of the mammalian type, and it may well be that the reptilian ancestors of the mammals, the therapsids, also had such a kidney. Kangaroos too compare well with placental mammals in other areas of water economy. For example, kangaroos and camels resemble each other in their cardiovascular response to dehydration: when they lose water, they adjust the volume of the vascular system so that the functioning of the heart is not jeopardized.

Adaptations involved in feeding and digestion provide interesting evolutionary comparisons between kangaroos and ruminants. Both lineages have arrived at a similar solution to the problem of living off plant tissues. It has often been suggested that the evolution of the mammals was closely associated with the simultaneous evolution of flowering plants. Early in the Cenozoic era these plants were largely woody types. By the Eocene, however, herbs and grasses had begun to spread, and in the Miocene, beginning some 25 million years ago, large areas of grassland covered the drier interiors of most continents. The evolution of grazing kangaroos appears to be associated with this spread of grassland in Australia, as does the expansion of the artiodactyl group of placental mammals elsewhere in the world.

No mammal can synthesize the enzymes that break down cellulose, the principal carbohydrate of grasses. The utilization of this food source calls for the evolution of a symbiotic association between the mammal and species of bacteria and protozoa that have such enzymes. The microorganisms take up residence in various expanded sections of the mam-



CHANGING GAITS of kangaroos range from pentapedal locomotion (*top*) typical of slow movement to high-speed hopping in excess of 40 kilometers per hour (*bottom*). In pentapedal locomotion the tail of the kangaroo serves as the third leg of a tripod, helping the animal to support itself on its forelimbs while the large hind limbs move forward. In low-speed hopping (*middle*) the tail assists balance but no longer acts as a support. Number of hops per minute is almost constant at speeds between 15 and 35 k.p.h. (about nine to 22 miles per hour); more speed comes from longer strides. High-speed hopping, from 40 to 50 or more k.p.h. (25 to 30 or more m.p.h.), requires still longer strides and faster hopping. These schematic representations are based on silhouettes of red kangaroos prepared by Frank Knight.



Digestion of cellulose made possible by the action of enzymes secreted by stomach bacteria, is a capability independently evolved both by the marsupial kangaroos and by placental ruminants. At left is the stomach of a red kangaroo, at right the stomach of an ox. The cellulose present in the diet of both grass eaters is largely broken down by fermentation before it passes into the intestine.

malian gut. In horses and rabbits they live in parts of the hindgut, such as the caecum. In ruminants they live in sections of the foregut and in specialized enlargements of the esophagus and stomach. There are marked advantages in allowing the plant material to ferment in such chambers before it reaches the stomach: both the products of fermentation and the microorganisms can be digested and absorbed along the entire length of the small intestine. The greater efficiency of this system may account at least in part for the fact that whereas the dominant herbivores of the Eocene were hindgut fermenters such as horses, these animals were displaced in the Miocene by a massive radiation of fore-stomach fermenters such as ungulates.

Kangaroos are fore-stomach fermenters, so that they share with such modern ruminants as cattle, sheep, goats, deer and camels the benefits of this type of digestion. Those benefits include a lower requirement for protein. Urea, formed by the breakdown of protein in the body, is returned in the saliva to the fore-stomach, where it is resynthesized into nutritive protein by the resident microorganisms instead of being entirely excreted in the urine and lost. This recycling enables kangaroos and ruminants not only to gain nourishment from the dry, low-protein grasses of the arid zone but also to conserve the body water that would otherwise be needed for the excretion of urea. The combination of this efficient mode of digestion and the low rate of marsupial metabolism gives the kangaroo a formidable array of characteristics for the successful exploitation of a dry grassland environment.

The picture of the kangaroo that has now been developed is one of a group of mammals that are not at all primitive but have adapted and radiated rapidly in recent times in response to a new and changing environment. That kangaroos still possess some characteristics that may be considered primitive is true, but it is also true that they have adopted ways of circumventing the limitations of these ancestral traits. Moreover, kangaroos, like other marsupials, have evolved abilities that surpass those of comparable placental mammals. Marsupials and placentals are close relatives; their separate evolution over 130 million years illuminates how there can be different evolutionary solutions to similar problems. It is a large jump from the tiny shrewlike mammals of the early Cretaceous to the hoofed mammals of the Old World and the Americas on the one hand and the kangaroos of Australia on the other. Historical records suggest that there are more kangaroos in Australia now than there were before the Europeans arrived. Thus it may be that, far from traveling a road to extinction, at least the large kangaroos of the arid zone are thriving in spite of competition with man and the ruminant stock he has introduced. This is probably attributable to an extension of a suitable arid habitat. That extension, however, has simultaneously reduced the habitat suited to the kangaroos' smaller relatives, the wallabies and the rat kangaroos. It is these marsupials that have largely disappeared from the interior of Australia.

BAITING: YES OR NO?

by Arjan Singh

I would like to touch on the vexed subject of baiting. This has been discontinued in Project Tiger areas in India. The reasons as far as I have been able to discover are as follows:

1. Excessive and uninhibited baiting may lead to conditioning animals to become dependent, and lose their killing techniques.
2. The baiting practice is inhuman, cruel and obnoxious to our traditional national culture.
3. Abnormal crowding caused by baiting leads to internicine agression.
4. Tethered baits encourage gang and piece–meal killing.
5. Baiting leads to an acquired taste as in the case of man–eating.

1. I fear I cannot go along with any of these arguments. It is correct that an excess of anything is bad. But to my way of thinking judicious and conditioned baiting does not lead to behaviourial or ecological abnormalities. Baiting during the four monsoon months is automatically discontinued. The technique of killing free–running prey is not all that different from the killing of a tethered bait and it is hardly likely that an animal with such inherited instincts like the tiger would lose its ability to capture fleet–footed animals. That is my experience over many years of baiting.
2. This anthropomorphic statement is incorrect. Baiting has been a practice ever since tiger hunting became the vogue. The normal tiger is a humane killer and prevailing conditions in abbatoirs and slaughter–houses are infinitely more inhuman and cruel. Also, contrary to uninformed opinion, the buffalo in the forest suffers no sense of impending doom.
3. Behavioural procedures on kills are governed by a strict tenure system in which the killer feeds first. Vocalisation, scent marking and scrapes are spacing mechanisms whereby different tigers may feed on one kill without conflict. Water shortage during the hot weather is a far greater cause of concentrations when tigers are apt to crowd the remaining water–holes. Internecine agression usually takes place not at kills, but during the mating season, and hence is a phenomenon outside the purview of management procedures.
4. The tiger is a lone hunter, and gang and piecemeal

killing is a reflex action whereby tigresses train their offspring to kill, as in Schaller's book when a mother was conditioning her three cubs. Such a natural phenomena cannot be condemned, and as an odious comparison birds are often purposefully winged at field trails to train and test gun–dogs.

5. Baiting does not lead to an acquired taste as in man–eaters as tigers cannot be choosy, but they do prefer wild prey to domestic buffaloes. Man–eaters are usually driven to such a preference by physical handicaps and necessity, and may even outgrow such an unnatural fare, as in suckling tigresses. Positive aspects of baiting may be for purposes of Tourism and scientific Research, for easing the pressure of wild ungulates and to aid gravid tigresses and those with young. Finally I must join issue with irresponsible statements with regard to conservation which unfortunately have become colloquial in wild life circles which matter. "we must not interfere with nature" "We must not build wildlife populations to artificial levels" etc. are shibboleths which we employ to do nothing. We have so degraded wildlife habitats by intensive forestry operations, by burning and other abusive practices, that we owe them some recompense. It is said that it takes 1,000 years to build one inch of topsoil. How many inches have we destroyed in the annual burns of grasslands and forest which we cannot prevent that we can afford to adopt the attitude of the three little monkeys? Forests and savannahs which are uncontrollably burned and degraded gradually develop coarse and hardy species as the soil fertility leaches out. As the soil fertility degenerates, less nutritious fodder grasses take over leading to the deterioration in the health of the ungulate population and their breeding rate. The predator population which depend on prey availibility adjust their populations to the growing food scarcity. Therefore the cyclic degradation of habitat has unleashed a vicious circle in which wildlife populations progressively fall below optimum levels. Therefore it is not fair, for whatever reason, to make a scapegoat out of nature, and expect her to repair the ravages we have perpetrated over the ages. Before tiger project and other areas can pontificate on definitive statements of "Thou shalt not" there must be a scientific management which shall decide upon the carrying capacity of the range, both for the herbivore and the carnivore in every wildlife area. Range capacities are infinitely flexible and I make bold to say that nowhere in India have any of our major wildlife areas reached optimum capacity. Natural processes are slow and it is incumbent upon us to accelerate this process by effective habitat manipulation, and artificial foraging aids to build an optimum ungulate poulation, with a possible initial carnivore baiting to assist in this build–up by relieving the pressure on interim populations. Different countries have different problems triggered by different circumstances, so after the whole of world theory has been digested, the solution will still lie with the toiler in the field.

For a more detailed and documented report on observations of tiger behaviour in the context of baiting, interested readers might like to write to Mr. Charles McDougal, who has had much experience with the procedure and has prepared a paper on the subject. His address is: Mr. Charles McDougal, Tiger Tops Jungle Lodge, P.O. Box 242, Kathmandu, Nepal.

WORLD–WIDE CAMPAIGN TO SAVE THE RHINO

The World Wildlife Fund and the International Union for Conservation of Nature and Natural Resources (IUCN) announced that they are joining forces with African and Asian Governments as well as other leading conservation organizations in a co–ordinated emergency campaign to save the rhinoceros. The World campaign will start in October 1979.

The IUCN/SSC Asian Rhino Group held a special preparatory meeting in Bangkok during August 1979. Their purpose was to outline a priority list of proposed conservation projects in Asia.

The three Asian species, the Great Indian, the Javan and the Sumatran rhinos, have existed in such small and threatened numbers for the past decade that their future survival is extremely uncertain.

The animal's extreme rarity is reflected in the current price of its horn – weight for weight, it is today more expensive than gold.

Conservation of an animal like the rhinoceros is a responsibility for the future.

The rhino provides a shocking lesson to the world of how greed and vanity can rob this and future generations of the planet's living resources.

Although they have survived since the Pleistocene era – virtually living prehistoric relics of an epoch which has left us only fossils of most of their ancient contemporaries – they will not survive much longer unless effective urgent measures are taken, through an International effort to save them.

MIGRATORY SPECIES CONVENTION: BONN

Conservationists have high hopes that by the end of June wildlife protection will have received a significant boost.

For by then the Convention on the Conservation of Migratory Species of Wild Animals should have been adopted. The Diplomatic Conference to accomplish this is being hosted by West Germany and will be held in Bonn on 11–23 June.

IUCN has been working towards this goal for several years. Although there are a number of international agreements concerning the conservation and management of migratory animals, they take many different forms and do not include all migratory species. This new comprehensive convention will go a long way to improving the situation.

The genesis of the convention can be traced to the 1972 UN Conference on the Human Environment. The concept was the subject of a special Recommendation (No. 32) and West Germany subsequently informed the UNEP Governing Council that it would assist in preparing a convention text. IUCN was contracted to provide expert help.

The draft text to be considered in Bonn is the product of extensive governmental consultations over the past few years. Global in scope, it recognizes that migratory species, a concept very broadly defined, are a resource to be conserved and managed by all States that exercise jurisduction over any part of the range of the species (Range States). The main focus is on species in special need of protection.

Species covered by the convention will be selected by the Conference of the Parties for inclusion in either or both of the two appendices. Appendix I is for species which are in need of immediate and stringent protection. Parties that are Range States for these species are required to take action laid down by the convention.

In Appendix II come species selected for concerted conservation and management measures. Range States for these species are required to conclude international agreements, with the emphasis on agreements which cover groups of species. The essential elements of these new agreements are provided in the draft which is thus intended to serve as 'umbrella' for any supplementary conventions on migratory animals.

International conventions often take a hideously long time to be developed. Meanwhile conservation problems grow. IUCN is therefore most concerned that the convention be finalized in Bonn this June. The Director General has written to IUCN members urging them to use their influence to see that their governments participate fully in the Diplomatic Conference.

IUCN will itself be participating through a delegation composed of representatives of the Secretariat, the Survival Service Commission, the Commission on Environmental Policy, Law and Administration and the Secretariat of CITES. The Union will be using its best efforts to assist in the final development of this much needed convention.

from **IUCN Bulletin** *May 1979*

GUNUNG GEDE–PANGRANGO: A NEW NATURE RESERVE IN WEST JAVA

In February, Minister of Agriculture Sudarsono Hadisaputro decreed that the 14,000 hectares of mountain forests remaining on the twin volcanoes, Gunung Gede and Gunung Pangrango, be established as a Nature Reserve in order to protect the biological aspects of the forest, develop new recreation areas, and to maintain a regular water supply for agriculture and for Jakarta.

The new reserve will be surrounded by a "buffer zone" which will be developed to help supply the local people with firewood, timber, charcoal, and other forest products needed for local consumption.

It is expected that the Nature Reserve will form the core area of a new National Park (once legislation is enacted), which will also include the long–established Cibodas Nature Reserve of 1,040 ha, the Cimungkat Nature Reserve of 56 ha, and part of the Situ Gunung Forest Recreation Area of 120 ha; an important adjunct to the new Park will be the Cibodas Botanical Garden, which will, however, remain under the control of the National Institute of Biology (LBN).

A management plan for the proposed Park has recently been completed by the PPA/FAO National Parks Development Project, and WWF is providing support to PPA in implementation of the plan. A large and impressive education center is being built with financial support from Caltex.

from **Conservation Indonesia,** *Vol 3, No 3 June 1979*

AUDIO VISUAL PRESENTATIONS

The World Wildlife Fund Education Project has designed and produced a new "mini" mobile Audio Visual Unit. Based on the well-proven and economical Renault Fourgon (7cwt) van, this unit has been specifically designed to meet the needs of education and extension officers in developing countries who are working on limited budgets.

As a mobile film unit, it can easily cater for audiences of up to 1,000 people. The public address system and the exhibition display panels allow it to be used in a wide variety of situations, whilst the portable generator enables both 16mm and 35mm projectors to be used in situations where the vehicle itself has no direct access.

Finally, the provision of specially selected photographic and recording equipment allows the operator to collect valuable resource material for future presentations.

The Education Project has now prepared more than 30 Audio Visual presentations (filmstrips and slide packs). In addition several programmes are being prepared for Indonesia.

For detailed information please write to

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PRIMATES OF SOUTH ASIA

1977. By M.L. Roonwal & S.M. Mohnot. Pp. xviii–421. Harvard University Press, London. Price £15.75.

Hindu mythology tells of how Hanuman the monkey god helped Prince Rama recover his wife Sita from the demon Ravana aided by an army of monkeys. In the South of India many temples are still dedicated to the honour of Hanuman. It is both this association and the Hindu belief that all creatures carry a spark of divinity that account for the abundance of macaques and langurs in public places throughout the Indian sub-continent.

This new volume will be welcomed by field biologists and primatologists who are concerned with the virtual disappearance of primates in so many other parts of the world. Professor M.L. Roonwal was for many years Director of the deservedly famous Zoological Survey of India and later Professor of Zoology and Vice Chancellor of Jodhpur University in Rajasthan. His co-author (S.M. Mohnot) has been engaged in ethological field research on the Hanuman langur *(Presbytis entellus)* for some time.

The Zoogeographical area covered by these authors extends over an area of 5¾ million km^2 and includes Afghanistan, Pakistan, India, Bhutan, Nepal, Bangladesh, Burma and Sri Lanka. Within this area there are twenty-five species of primate which include three tupaiids and two lorises, and together comprise eight genera.

In a general introduction the authors give a brief summary of the ecology and behaviour of primates, and introduce the reader to the main features of the geography of South Asia. Since the area extends from 6^{o} to 38^{o} North latitude it exhibits a wide range of temperature regimes which may be related to latitude and the presence of the Himalayan range in the north. Additionally annual variations in rainfall from less than 125 mm per annum to over 2,000 mm per annum results in an incredibly diverse vegetation ranging from tropical wet evergreen forest to semi-desert and alpine grassland.

The bulk of this work is arranged as a systematic account of all the primates known in the area with each species being dealt with separately. These summaries are dealt with under four headings: (1) Tupaiidae (tree shrews) three species; (2) Lorisidae (lorises and galagos) two species; (3) Cercopithecidae (macaques and langurs) eighteen species; Hylobatidae (gibbons) two species.

Only two of the six known living genera *(Anathana* and *Tupaia)* of the Tupaiidae occur in South Asia, about which very little is known of the two Indian (including Nicobar) species although the tree shrew *(Anathana ellioti)* is said to occur over most of India south of the Ganges. The third species *(Tupaia glis)*, whose range extends throughout southeast Asia has been studied more extensively.

The distribution of the Lorisidae are of special interest for they provide an interesting zoogeographical affinity between Africa and South and South-East Asia, to which areas these nocturnal primates are confined. The slender loris *(Loris tardigradus)* being restricted to southern India and Sri Lanka and the slow loris being widespread from eastern India and Burma to Indonesia and the Philippines. It is perhaps a reflection of an early passionate interest in natural history in India and South-East Asia that leads us to early authors such as Blandford (1888–91) for quite detailed descriptions of their basic ecology.

The old world monkey family, the Cercopithecidae, comprises thirteen genera which are confined to Africa and Asia. Interestingly only *Macaca* is common to both these regions. These species whose habits were well adapted to living close to human dwellings and taking advantage of the Hindu tolerance of these visitors not surprisingly prove to be those animals which are both widespread and the best known. Included amongst these is the stump tailed macaque *(Macaca arctoides)*, the rhesus monkey *(M. mulatta)*, and the Hanuman langur *(Presbytis entellus)*.

In spite of the large amount of knowledge that has accumulated on these species both in the wild and in captivity we soon realize that many species are still little studied and often in considerable danger from reduction of their range.

Only two members of the Hylobatidae occur within South Asia, and both of them are restricted to its eastern borders. Of these two the Hoolock gibbon *(Hylobates hoolock)* is most in need of study.

In an important work of this nature is difficult to find fault, but the inclusion of a section on the conservation priorities for South Asian primates would be of great value especially for those species whose range is restricted and their habitat in danger.

The seventy-four page bibliography will prove an invaluable source for any sociobiologist contemplating a study of South Asian primates. It is much to be hoped that this new work will stimulate a new interest amongst Indian biologists in the primates in particular and the mammals in general, for in an area where pressures on the land are so great many species may well disappear along with the habitats to which they are so often restricted.

Malcolm Coe

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